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ABSTRACTS

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ABBREVIATED TITLES USED IN THE ABSTRACTS

Abbreviated Title.	*Journal.*
Aircraft Eng.	Aircraft Engineering.
Analyst	Analyst.
Ann. des Comb. Liq.	Annales de l'office National des Combustibles Liquides.
Ann. Min. Roum.	Annales des Mines de Roumanie.
A.P.I.	American Petroleum Institute.
Asphalt u. Teer	Ashphalt und Teer.
Aut. Ind.	Automotive Industries.
Auto. Eng.	Automobile Engineer.
Aviation	Aviation.
Azerb. Neft. Khoz.	Azerbaldzhanskoe Neftyanoe Khozyaistvo.
Bitumen	Bitumen.
Bohrt. Ztg.	
Boll. Inform. Petroleras (B.A.)	Boletin de Informaciones Petroleras (Buenos Aires).
Brenn.-Chem.	Brennstoff-Chemie.
Bull. Amer. Assoc. Petr. Geol.	Bulletin of the American Association of Petroleum Geologists.
Bull. Assoc. Français T.P.	Bulletin de l'Association Français des Techniciens du Pétrole.
Bull. Perm. Int. Assoc. Road Cong.	Bulletin of the Permanent International Association of Road Congresses.
Bur. Stand. J. Res.	U.S. Bureau of Standards Journal of Research.
Bur. Mines Bull.	U.S. Bureau of Mines Bulletin.
Bur. Mines Repts. Invest.	U.S. Bureau of Mines Reports of Investigations.
Bur. Mines Tech. Paper	U.S. Bureau of Mines Technical Paper.
Canad. J. Res.	Canadian Journal of Research.
Chem. Age	Chemical Age.
Chem. Markets	Chemical Markets.
Chem. Met. Eng.	Chemical and Metallurgical Engineering.
Chem. Rev.	Chemical Reviews.
Chem. Trade J.	Chemical Trade Journal.
Chim. et Ind.	Chimie et Industrie.
Chimica e l'Industria	La Chimica e l'Industria.
Compt. rend.	Comptes rendus hebdomadaires des Seances de l'Academie des Sciences.
D.E.U.A.	Diesel Engine Users Association.
Diesel Power	Diesel Power.
E.P.	English Patent.
Econ. Geol.	Economic Geology.
Eng. Min. J.	Engineering and Mining Journal.
Eng. News Record	Engineering News Record.
Engineer	Engineer.
Engineering	Engineering.
Explosives Eng.	Explosives Engineer.
For. Petr. Techn.	Foreign Petroleum Technology.
Fuel Economist	Fuel Economist.
Fuel	Fuel in Science and Practice.
Gas & Oil Power	Gas and Oil Power.
Gas J.	Gas Journal.

Abbreviated Title.	*Journal.*
Gas World	Gas World.
Geol. Mag.	Geological Magazine.
Geol. Surv. Canada	Geological Survey of Canada.
Geophysics	Geophysics.
Giorn. Chim. Ind. Appl.	Giornale di Chimica Industriale ed Applicata.
Goryuchie Slantzui	Goryuchie Slantzui.
Groz. Neft	Groznenskii Neftyanik.
Helv. Chim. Acta	Helvetica Chimica Acta.
Ind. Chem.	Industrial Chemist.
Ind. Eng. Chem.	Industrial and Engineering Chemistry.
Ind. Eng. Chem. Anal.	Industrial and Engineering Chemistry, Analytical Edition.
India Rubber J.	India Rubber Journal.
Instr. World	Instrument World.
Instruments	Instruments.
J.A.C.S.	Journal of the American Chemical Society.
J. Amer. Petr. Inst.	Journal of the American Petroleum Institute.
J. Applied Chem. (U.S.S.R.)	Journal of Applied Chemistry (U.S.S.R.)
J.C.S.	Journal of the Chemical Society.
J.C.S. Japan	Journal of the Chemical Society of Japan.
J. Geol.	Journal of Geology.
J. Fac. Sci. Hokkaido	Journal of the Faculty of Science, Hokkaido Imperial University, Japan.
J. Fuel Soc. Japan	Journal of the Fuel Society of Japan.
J. I. A. E.	Journal of the Institution of Automobile Engineers.
J. Inst. Elect. Eng.	Journal of the Institution of Electrical Engineers.
J. Inst. Mar. Eng.	Journal of the Institute of Marine Engineers.
J.I.P.T.	Journal of the Institution of Petroleum Technologists.
J. Inst. Fuel	Journal of the Institute of Fuel.
J. Phys. Chem.	Journal of Physical Chemistry.
J.S.A.E.	Journal of the Society of Automotive Engineers.
J.S.C.I.	Journal of the Society of Chemical Industry.
J. Sci. Instr.	Journal of Scientific Instruments.
J. Soc. Petr. Geophysicists	Journal of the Society of Petroleum Geophysicists.
Khim. Tverd. Topliva	Khimiya Tverdogo Topliva
Mar. Eng.	Marine Engineer.
Mat. Grasses	La Matieres Grasses.
Mech. Eng.	Mechanical Engineering.
Min. Elect. Eng.	Mining Electrical Engineer.
Min. & Metall.	Mining and Metallurgy.
Mon. Petr. Roumain	Moniteur du Petrole Roumaine.
Nat. Petr. News	National Petroleum News.
Nature	Nature.
Neft.	Neft.
Neft. Khoz.	Neftyanoe Khozyaistvo.
Nov. Neft.	Novosti Neftepererabotki.
Nov. Tekhn. Bur.	Novosti Tekhniki Bureniya.
Nov. Tekhn. Neft.	Novosti Tekhniki Neftedobvichi.
N.Z. Dept. Sci. Ind. Res.	New Zealand Department of Scientific and Industrial Research.

Abbreviated Title.	*Journal.*
Öle, Fette, Wachse	Öle, Fette, Wachse, Seife, Kosmetik.
Oel u. Kohle	Oel und Kohle vereinigt mit Erdoel und Teer.
Oil and Colour Trades J.	Oil and Colour Trades Journal.
Oil & Gas J.	Oil & Gas Journal.
Oil Bull.	Oil Bulletin.
Oil News	Oil News.
Oil Weekly	Oil Weekly.
Olii Min.	Olii Minerali.
Paint Manufacture	Paint Manufacture.
Petr. Eng.	Petroleum Engineer.
Petr. Times	Petroleum Times.
Petr. World.	Petroleum World.
Petr. World (L.A.)	Petroleum World (Los Angeles).
Petr. Z.	Petroleum Zeitschrift.
Physics	Physics.
Pipe Line News	Pipe Line News.
Proc. Assoc. Asphalt Paving Tech.	Proceedings of the Association of Asphalt Paving Technologists.
Proc. K. Akad. Wetensch. Amsterdam	Koninklijke Akademie van Wetenschappen te Amsterdam.
Przem. Naft.	Przemysl Naftowy.
Rec. Trav. Chim.	Receuil des travaux chimiques des Pays-Bas.
Rev. Comb. Liq.	Revue de Combustibles Liquides.
Rev. Petr.	La Revue Petrolifere.
Refiner	Refiner and Natural Gasoline Manufacturer.
Roads and Road Constr.	Roads and Road Construction.
Science	Science.
Scientia	Scientia.
Sed. Petr.	Sedimentary Petrography.
Teer u. Bitumen	Teer und Bitumen.
Terrestrial Magnetism	Terrestrial Magnetism.
Trans. Faraday Soc.	Transactions of the Faraday Society.
Trans. Petr. Geol. Res. Inst. Leningrad	Transactions of the Petroleum Geology Research Institute, Leningrad.
U.S. Geol. Surv.	U.S. Geological Survey.
U.S.P.	United States Patent.
World Petr.	World Petroleum.
Z. für. Geophysik	Zeitschrift für Geophysik.

ABSTRACTS.

	PAGE
Geology	2 A
Drilling	8 A
Production	11 A
Pipe-Lines	13 A
Crude Petroleum	16 A
Chemistry of Petroleum	17 A
Refining and Refineries	19 A
Cracking	21 A
Gas	22 A
Motor Fuels	23 A
Lubricants	24 A
Asphalt and Bitumen	25 A
Special Products	27 A
Engines	28 A
Detonation	30 A
General	30 A
Reviews and Books Received ...	30 A

AUTHOR INDEX.

The numbers refer to the Abstract Number.

Adam, L., 63
Akt. Separator Nobel, 79
Albright, J. C., 34
Allen, A. O., 91
Andrews, C. A., 18
Anschicks, R. J., 40
Archibald, F. M., 76

Baker, A. A., 4
Baldeschwieler, E. L., 89
Barrabé, M. L., 14
Bataafsche Petroleum Mij., 76
Bayley, C. H., 74
Bierhalter, W., 85
Bignell, L. G. E., 22, 27
Blau, L. W., 40
Brewster, W. G., 28
Briner, E., 54
British Thomson-Houston Co., 79
Burmah Oil Co., 79

Cambron, A., 74
Campbell, H. C., 91
Carceller, J., 54
Carr, R. H., 40
Chaney, L. V., 76
Clark, L. V. W., 41
Clarke, L. A., 79
Crandell, J. S., 54
Csegoly, J., 83

Dimmig, H., 72
Dunstan, A. E., 63

Egloff, G., 76
Eming, E., 65
Evans, E. A., 78
Evans, S., 40
Ewing, S., 50

Fallah, B., 41
Fieser, L. F., 60, 61
Fletcher, H. W., 40

Gabler, G. C., 47
Garton, E. L., 51
Gee, W. P., 79
Gilbert, L. C., 82
Gilbert, W. E., 17
Gomory, W. L., 72
Grant, J., 28
Gray, T. T., 76
Gregory, P. P., 30

Hague, E. N., 62
Halse, G. W., 2
Herschberg, E. B., 60
Howes, D. A., 62
Hulster, J. de, 59
Humphrey, H. C., 40
Hunter, T. G., 68

Ibrig, H. K., 52
Ipatieff, V. N., 58, 74

Janssen, P., 76
Jasper, T. M., 25
Jones, G. W., 73

Kennedy, R. E., 73
Kerr, G., 67
Kesper, J. P., 65
Kiser, M., 79
Koester, E. A., 3
Kriege, H. F., 82

Lacey, W., 29
Lane, E. C., 51
Lane, W. C., 5
Lang, W. E., 40
Larouche, —, 77
Leendertse, J. J., 55, 59, 63
Le Roi, E. J., 66
Levorsen, A. I., 10
Link, T. A., 1
Logan, K. H., 48
Louis, —, 77

McKay, C. B., 79

Manley, R. E., 79
March, R. A., 17
Marvel, C. S., 57
Mason, V. V., 24
Maverick, G. M., 89
Mayo, F., 68
Mayor, Y., 87
Meyer, K. N., 53
Mills, B., 20, 21
Mond, A. L., 76
Morgan, B. W., 72
Morrell, J. C., 76
Mudd, O. C., 47
Musselman, J. M., 79

Naritimi, M., 19
Nash, A. W., 41, 68
Neudeck, J. B., 89
Newcome, R. B., 32

Oksenholt, J. N., 28
Osgood, W. H., 36

Parker, R. W., 43
Parsons, C. P., 16
Pease, R. N., 51
Peski, A. J. van, 79
Pettit, O. W., 79
Pew, A. E., 72
Pines, H., 58
Pirson, S. J., 31
Plummer, F. B., 32
Post, E. S., 26

Reed, H. S., 72
Rhodes, G. I., 42
Rice, O. K., 91
Robinson, B. H., 37
Rogers, W. F., 46
Ryder, L. L., 57

Saatjian, K. N., 24
Sage, B. H., 29
Saruchanoff, N., 69
Schneegans, M. D., 14
Schulze, W. A., 76
Schwarz, R., 94
Scott, G. N., 80
Seligman, A. M., 61
Shaw, S. F., 38, 39
Smith, J. H., 79
Speller, F. N., 23
Standard Oil Development Co., 79
Starr, J. V., 79
Stockman, J. P., 12
Stratford, W. M., 72
Sullivan, F. W., 72
Svenska Akt. Gas Accumulator, 69
Swindell, F., 33
Syabo, G., 28

Taylor, F. B., 44
Thayer, S., 49
Thompson, J. K., 92
Thompson, S. A., 6
Towers, L. H., 35
Tsutsumi, S., 75
Turner, S. D., 66
Tuttle, M. H., 79

Uljanov, A. W., 8
Universal Oil Products Co., 69

Vlodrop, C. van, 63
Vogt, C. J., 90
Vokac, R., 81

Waterman, H. I., 55, 59, 63
Wheeler, R. V., 92
Williams, N., 71
Wilson, R. E., 72
Wood, A. M., 72
Wood, J. H., 45
Woods, H. B., 40

Young, H. J., 88

Zuber, S., 9

Geology.

55 (712.2)

1. Types of Foothills Structures of Alberta, Canada. T. A. Link. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1427–1471.—Descriptions are given of various structures in the foothills of Alberta, mostly from the area south of Bow River. The descriptions are well illustrated by maps, cross-sections, and photographs. The structures are: Twin Butte Overthrust sheet, Mill Creek, Rice Creek, Highwood–Waite Valley uplift, Pekisko hills, Turner Valley, Outwest Overthrust sheet, Fisher mountain thrust sheet, Jumping Pound, Lovett-Coalspur Anticline. Various minor structures and palæozoic limestone outliers are also described. These point to simple fault blocks dipping towards the west as being the most prevalent type of structure. The pressure of low angle thrust faults, however, is the dominating factor in this zone, and it is the position of these that determines the possibility of reaching productive horizons. Surface evidence on this matter is not helpful, the dips of the exposed fault planes being invariably high, and giving no clue to the angle at depth, although in a few cases the sinuous outcrop of the fault plane does suggest a low angle dip. S. E. C.

55 (729.87)

2. Notes on the Geology of South Trinidad. G. W. Halse. *J.I.P.T.*, 1935, **21**, 940–951.—A paper, with discussion, held at the Trinidad branch, on the Forest Sands and Cruse Sands, with special reference to Palo Seco, describing in detail the geology of this region. G. R. N.

55 (781)

3. Geology of Central Kansas Uplift. E. A. Koester. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1405–1426.—The Central Kansas uplift has been revealed by deep drilling, and only during the past few years has any conception of its significance arisen. Its history appears to be more closely related to that of the Ozarks than to the areas to the north or south. The structure strikes N.W.–S.E. across Central Kansas, and probably across part of Nebraska, and, from a consideration of the pre-Cambrian rocks, the uplift appears to have originated as a series of more or less parallel batholiths intruded into schist and quartzite. Erosion exposed the granite core, and the lowest Palæozoic sediment (Ordovician sandstone) partly or wholly covered this. A sandy dolomite was deposited on this, in places overlapping it to rest on the pre-Cambrian. Then followed a general emergence of the uplift corresponding to similar movements in the Ozark and Arbuckle areas, from which resulted the general N.W.–S.E. trend of the structure. The uplift was not covered again until late in Simpson time (Up. Ordovician). During the Mississippian it was elevated and folded along N.E.–S.W. lines at the same time as were formed the Nemaha ridge and the intermediate McPherson and Ellsworth anticlines.

Warping and folding of the uplift occurred throughout Pennsylvanian and Permian times. Post-Permian westward tilting had little effect, but post-Cretaceous movements revived the N.E.–S.W. anticlines and flattened the regional dip of the Cretaceous across the core.

A description of the stratigraphy of the area and details of its structure are given. S. E. C.

55 (792)

4. Geologic Structure of S.E. Utah. A. A. Baker. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1472–1507.—The area described includes most of the northern part of the Colorado Plateau, and in structure contrasts with the intensely folded Rocky mountains to the east and the Great Basin to the west. The structures found there may be divided into four groups, viz.: (1) large anticlines and synclines with associated minor folds, (2) folds and faults in an area underlain by thick saliferous deposits, (3) folds related to laccolithic intrusions, and (4) a zone of faults and associated folding in a N.–S. direction.

The first group of structures is typified by a series of regional uplifts in the form of long, asymmetrical domes with short, steeply dipping east flanks and long, gently dipping west flanks. Minor folds are present on the crests and flanks.

The second group is confined to the area which formed the basin of deposition for the Paradox saliferous series. The effect of this plastic series has been a modification of the broad structural features by the superimposition of a N.W.–S.E. series of faults and folds. In some cases the salt series has been intruded into the crests of the folds. The group of folds related to laccolithic intrusions includes the type locality for such folds, the Henry mountains. Other examples are the La Sal and the Abajo mountains, and probably also the Navajo mountains. The fourth group of structures forms the boundary between the Colorado Plateau and the Great Basin.

Little is known of the structural history of the region prior to the Carboniferous on account of lack of data. The first important period of folding which can be traced was at the close of the Mississippian. Other movements occurred in the Permian, Trias and Upper Jurassic. The greatest movement took place, however, at the end of the Cretaceous, this being contemporaneous with the orogenic movements in the Rocky Mountains. The large asymmetrical domes mentioned earlier were formed then, and it is suggested that they were caused by E.–W. compressive forces folding the sediments above steep reverse faults in the basement rocks. Details of movement during the Tertiary are not clear, since only Eocene rocks are known in the area, and those have been much eroded. Such evidence as is available points to regional movement and local deformation which is associated with igneous intrusions. The laccolithic mountains were formed at this period. S. E. C.

550.361 536.531

5. Resistance Pyrometer for Measuring Subsurface Temperature. W. C. Lane. *Petr. Eng.*, October 1935, **7** (1), 54.—As a means for determining bottom-hole temperature a resistance pyrometer has been devised. The pyrometer consisted of a spool of No. 31 cotton-covered copper magnet wire, condenser tubes and No. 12 solid hard-drawn duplex rubber-covered copper wire. Resistance measurements were carried out on a Wheatstone bridge. About 1000 ft. of No. 31 wire were wound on a wooden bobbin after a coat of insulating compound had been applied. The whole assembly was then given another coat of insulating compound and covered with a layer of varnished cambric.

A section of brass tubing was then cut, and one end closed by brazing a disc of copper in it. A stuffing-box was screwed into the other end. The coil was then inserted in the tube, the space filled with transformer oil and the instrument was then calibrated.

In using the device on the heating test the tube was attached to the perforated pipe just below the pump barrel and leads carried to the surface. The resistance was measured by means of a post-office type Wheatstone bridge. L. V. W. C.

551.7 (764)

6. Fredericksburg Group of Lower Cretaceous with Special Reference to North Central Texas. S. A. Thompson. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1508–1537.—Descriptions are given of measured sections in ten localities from Red River to Williamson County. In the classification adopted the Walnut clay, Comanche Peak limestone, and Edwards limestone are members of the Gatesville formation, which, with the Kiamichi formation, forms the Fredericksburg group. This classification is supported by the fact that Oxytropidoceras and Diploceras have a time range restricted to the period from early Walnut to late Kiamichi. Also, there is some evidence of a break in sedimentation at the end of the Kiamichi as well as at the contact of the Walnut and the underlying Trinity group.

The Walnut member is shelly in the lower part, whilst the upper part is a yellow marl passing up into the white chalky limestone of the Comanche Peak member. This again passes gradually into the hard massive limestone of the Edwards member. As a contrast to the indefinite boundaries between these members of the Gatesville formation, the boundary between the Gatesville itself and the Kiamichi is much sharper. The Kiamichi is essentially clay. S. E. C.

553.981 : 553 (914.39)

7. Natural Gas in Hungary. Anon. *Petr. Z.*, 2.10.35, **31** (39).—After some ten months' exploration work with torsion balance and with magnetic methods it was

shown that a N.E.–S.W. striking anticline occurs in the subsurface of the Hungarian Plain in the neighbourhood of Osli, Szárföld, Mihályi and Répcelak. Calculations showed the " maximum " to be near Mihályi in the Soproner Komitat, and a location was accordingly made. Drilling by the rotary method commenced on 20th February, 1935, and finished in the basement rocks at a depth of 1603 m. in June. Pontic deposits were found above the basement complex, and these included several sand and sandstone horizons, the last 100 m. of which were tested. After a blow-out on 23rd July the well was brought under control and allowed to produce through a 6-mm. bean. The pressure was then 65 atmospheres. The composition of the gas is 95% CO_2 and 5% inflammable gases (methane, etc.). Daily production exceeds 100,000 cu. m.

S. E. C.

553.982

8. Upper-Edge Waters and their Significance. A. W. Uljanov. *Petr. Z.*, 7.8.35, **31** (32), 13–15.—Examples are taken from the Kirovche area (Apsheron Peninsula) and Miraanishe, Georgia. From analysis of various waters it is suggested that while bottom-edge waters are mainly a solution of alkali carbonates, the upper-edge waters contain a significant content of sulphate and approach the composition of surface waters. This shows that upper-edge waters are formed from the time that surface water begins to enter the oil horizon. The water gradually penetrates downward until it disappears at the contact with the oil-bearing zone. Variations in the sediment cause isolated patches where slight oil-shows are obtained. The depth and velocity of penetration depend on a number of factors, lithology, etc. It is to be presumed that this process continues until all the oil has been forced out of the sediment and the upper- and lower-edge waters meet and mix completely. Until such time the upper-edge water will exert a certain pressure on the oil. This phenomenon is found in the case of monoclinal structures and eroded anticlines, and careful examination of waters in such a zone should be made to determine whether there are any possibilities of production.

S. E. C.

553.982

9. Mediterranean Type of Oil Deposits. S. Zuber. *Petr. Z.*, 12.6.35, **31** (24).—The Mediterranean deposits belong stratigraphically almost without exception to the Neogene, and especially to the Middle and Upper Miocene. They appear to follow the small-edge basins of great mountain units of pre-Miocene age, these basins being similar to the numerous brown-coal basins. The sediments have a mixed character, mainly sand and clay, and ranging from salt to brackish and fresh-water in type. Their tectonic and palæogeographic history corresponds to two factors, gradual sinking of the basin with intensive sedimentation and a characteristic block faulting, often with shrinking as a result of tangential movement. The structure of the basement rocks, which are usually more competent than the Neogene sediments, corresponds in general to the pre-Miocene tectonics. The brown coals are intimately related to the petroliferous strata, and the same horizon may alternate between being petroliferous and brown-coal bearing. The coals are very bituminous, with an average of 10–15% matter soluble in carbon tetrachloride. The oil is generally of a heavy character—sp. gr. 0·92–0·98—and with a high sulphur content. It is often a benzene–asphaltic type with a very low content of medium-boiling-point fractions. Oil-field waters are rare, and when they occur they are either in easily recognizable and restricted horizons or are connected with surface infiltration. Circulation of the waters is hindered by the lenticular form of the sands. Oil-shows are numerous around the edges of the basins, but prospecting is rendered difficult by the numerous disconformities.

S. E. C.

553.982

10. Time of Oil Migration and Accumulation. A. I. Levorsen. *Oil Weekly*, 18.11.35, **79** (10), 16.—Generally it has been assumed that petroleum has remained more or less stagnant in its original dispersed condition until a period of folding initiated its movement. Here it is suggested that oil begins to move soon after its formation, due to initial dip of the beds, compaction and other factors, in addition to regional tilting. Thus there is up-dip migration to regional highs due to gravity differences.

These highs are usually on the basin edges, further movement being prevented by impervious beds overlapping the reservoir rocks, and by lateral changes in porosity. This primary migration leads to a regional segregation of oil and its broad concentration in the structurally high parts of the basins.

When folding occurs later, local traps are formed into which the oil moves by secondary migration, giving a much greater concentration of oil at these points. Local traps within the areas of primary regional accumulation are consequently much more productive than similar traps outside these areas. Continuous protection against leakage is, therefore, very important. This concept shows clearly why many traps, and even entire formations which are otherwise favourable, prove barren of oil. G. D. H.

553.982 : 553 (766)

11. Southern Oklahoma Deep Gusher. Anon. *Oil & Gas J.*, 31.10.35, **34** (24), 9–11.—A recent well drilled at Fox Pool, Carter County, has given hopes of deep production over a large area south and south-west of the Arbuckle Mountains. The discovery well is incomplete, and not yet under full control, but it is estimated at 10,000 brl. per day. From data available, production is thought to come from the Simpson at a depth of 8088 ft.

This discovery will lead to further deep drilling in the Ardmore–Anadarko Basin, and also in the area to the south of these basins. A great deal will depend on the thickness of strata to be penetrated before the Ordovician sands are reached. If the entire thickness of beds above the Mississippian is present, the total would be about 20,000 ft. On the other hand, it is possible that the maximum thickness of some of the formations will not be present on some of the structural highs, due to lack of deposition on a pre-existing high or to subsequent erosion.

Future drilling should be confined to the crests of anticlines, on the assumption that the structures in the Lower Palæozoic may be steeper, and the area of accumulation considerably smaller, than in the Pennsylvanian. J. A. G.

553.982 : 553 (794)

12. California Needs 200,000,000 Barrels of New Crude Reserves Each Year. L. P. Stockman. *Oil & Gas J.*, 7.11.35, **34** (25), 87–116.—The San Joaquin Basin, although several times larger, is geologically similar to the Los Angeles Basin. Both contain about 5000 ft. of source rocks with overlying sands which act as reservoirs. The San Joaquin Basin is primarily a great block that has been tilted westward; this movement has brought up granite on the east, but westwards, as the centre of the basin is reached, the sediments gradually increase to a very great thickness. It is in this area that further exploration should take place. Geophysical surveys have been conducted in the basin, and will probably be followed by test wells on favourable structures. On the eastern side of the basin, production is from the Temblor (Middle Miocene), which occurs unconformably below the Pliocene, the accumulation being controlled by faulting. The Miocene appears to have been deposited on an uneven granitic basement, and here has a maximum thickness of 3950 ft., which increases southwards.

The Los Angeles Basin is a deep depression, bordered on the N. and S. by almost vertical faults, in which has been deposited about 15,000 ft. of Tertiary sediments. These thin out towards the edges, where basement rocks outcrop or are encountered at very shallow depths. The most prolific fields are in the centre of the basin and situated on two lines of folding, the Newport–Beverly Uplift and the Coyote Hills Uplift. All the producing structures so far discovered are represented at the surface by low-lying hills or swells. Production is from the Pliocene and Miocene, but some fields seem to have excellent chances of proving deeper production from the Temblor and Vaqueros (Lower Miocene), the Sespe (Oligocene), and possibly certain formations in the Eocene. At Long Beach and Santa Fe Springs the Temblor is expected to be found at 10,000 ft. These deeper horizons are absent in the more easterly fields, where schists, etc., have been found below the present producing horizons.

The Ventura Basin, though smaller than the San Joaquin Basin, contains approximately 20,000 ft. of Fernando (Pleistocene, Pliocene, and Miocene), underlain by about 8000 ft. of Modelo and Vaqueros (Miocene) and Sespe (Oligocene). Ventura

Avenue is the main field, and is situated in the south central part of the basin. There is only one major dome in this field, but it has an enormous drainage area. The Pliocene has not yet been drilled through, although commercial production has been proved below 9700 ft. If the Lower Miocene, Oligocene and Eocene are present in the same thickness as elsewhere, and provided oil can exist at such a depth, the total thickness of potentially productive sediments must be about 20,000 or 25,000 ft.

A detailed survey of the other main fields in these basins is given, and the possibility of deep production is discussed in each case. Among those with the most promising chances may be placed, North Belridge, Elk Hill, Seal Beach and Inglewood.

J. A. G.

553.982 : 553 (847)

13. Recent Developments in the U.S.S.R. *Petr. Z.*, 25.9.35, **31** (38).—Both proven and unproven areas are being investigated by the State petroleum geologists under the leadership of Prof. Gubkin. A large number of test borings in the Apsheron peninsula have shown extensions of the productive zones in the Lenin field (Balachany) and in the Ordzonikidze field (Surachany). The geologists state that a further 183,000 m. of exploratory boring will be needed during the period 1935–36. Deep drilling has also been undertaken in other parts of the peninsula, particularly near Mardachany. Three wells produced gas, and also found oil-sand at depth. The crest of the Mardachany anticline lies north of the coast, and drilling will take place between it and the coast. Eleven wells in the Zych district have been deepened, and two found sand from which a small production is obtained. Other areas are Schongar, N.W. of the Ger-Gez field and structurally similar to that field, the Puta field, and Kabristan, 150 km. S.W. of Baku, where fourteen wells have been drilled, and where the outlook over a large area is promising.

Recent investigations in the Maikop area show the reserves to be over 47 million tons. Problems of deep drilling will have to be overcome in this area.

The area N.W. of the Asovchen sea from the coast of the Black Sea to Krimskaja is interesting, but, unfortunately, little known. There is an unbroken chain of oil-shows from Krimskaja to Kutaiskaja, numerous mud volcanoes on the Taman peninsula, and gas-shows as far as the harbour of Sotshi.

In the South Iskin field in the Emba district a crude with 64% light fractions has been obtained and three new wells started.

On the N.W. coast of the Baikal sea, Siberia, eight wells have been commenced and two have already found oil at 95 m.

Oil shale is being mined in the Gdow district, and 300,000 tons are expected to be produced during 1935.

S. E. C.

553.982 : 553 (848.4)

14. Gabian (Hérault) Petroliferous Area. M. L. Barrabé and M. D. Schneegans. *Ann. des Comb. Liq.*, 1935, **10**, 595–662, 819–888.—Gabian is situated on the southern margin of the Palæozoic massif of the Montagne Noire. South of this massif are pre-Hercynian formations: Silurian, Devonian and Carboniferous, up to and including the Viséan, strongly folded and possibly with some over-riding. On the southern edge of this series is a transgressive succession of coal-bearing and Mesozoic rocks, forming a narrow band along the Montagne Noire. Near Gabian this includes coal-bearing Stephanian which seems to be localized in two small basins; transgressive Autunian beginning with a conglomerate containing blocks of Devonian dolomite. Next comes a series of carbonaceous shales, fine-grained dolomites, and some intrusives. The lower Trias (perhaps Permo-Trias) is a thick series of reddish clays, green mottled at times, and sands, with red or yellow dolomitic intercalations and red conglomerates. Middle Trias consists of thickly bedded yellow dolomite with dolomitic breccias and conglomerates, and at times there are clays and grey, reddish or greenish marls in the middle part. The Keuper has grey and reddish marls with thick gypsum bands and dolomitic horizons. The Lias is rarely complete, and includes, at times, the marly, calcareous and sometimes sandy Rhaetic, the massive lower Lias limestones and upper Lias marls of the Domerian, Toarcian and Aalenian. The Bajocian and perhaps Bathonian are represented by flinty and dolomitic limestones. The above rocks seem to dip quite regularly to the S.S.E. (under Miocene and Pliocene which extend to the sea).

After prolonged erosion, probably extending over much of the later Mesozoic and

Nummulitic periods, the ancient valleys of the Montagne Noire were inundated and red and yellow Miocene (possibly Helvetian) clays were deposited in them. On these lie transgressive marls and bluish molasses with Ostrea crassissima of the Helvetian, and these extend northwards as far as the edge of the Palæozoic massif. A second phase of emersion and erosion was followed by the deposition of red, pebbly fluvio-marine clays over much of the area between Montagne Noire and the sea. During the Pliocene basaltic outflows must have covered large areas. Only remnants of these outflows remain, and some of them were considered to be plugs.

The lithology and succession in various parts of the region are given in considerable detail. Many wells have shown the absence of lower Lias between the upper Lias marls and the gysiferous Keuper marls. Various wells differ from the normal section in that certain horizons are missing. This may be due to the structure, although an original depositional cause is not impossible. The reddish, yellowish or brownish pebbly clay lying below the bluish Helvetian molasse has commonly been recorded as Pliocene, which is similar, and in the north the Pliocene may rest directly on this and be distinguishable only with difficulty.

There have been several orogenic phases. The Hercynian movements only affect the ancient massif. Tertiary folds (upper Eocene) may be the only ones to affect the southern carboniferous margin of the Montagne Noire. These folds have been localized in the search for oil, and have an E.N.E.–W.S.W. trend parallel to the southern edge of the Montagne Noire. There are imbrications and over-ridings, and the Trias shows similar structures, indicative of a thrust from the S. or S.S.E. Jurassic beds are also involved, and a post-Lutetian date is necessary to account for some of the folds. The middle Miocene is scarcely undulating.

The outcrops and structure of the Tongue valley are described fully, together with the history of the seepage and the attempts to develop it. There is a complete list of the wells drilled, giving the sites in relation to the geology, the well logs and interpretation of the sections, and the results obtained on completing the well.

The lower and middle Trias conglomerates and breccias appear to be the reservoir rocks, with a capping of Keuper marls. Porosity is variable, and there is evidence of water pockets. The impregnation is best in the upper parts near the Keuper marls. The mother rock is difficult to ascertain. The Autunian shale and perhaps also the Stephanian are the only pre-Trias formations with much organic matter which could have been the source. A possibility of origin *in situ* is recognized, also the occurrence of solid bitumen in Devonian limestone, and the opportunities for lateral migration through overthrusting, but the Autunian is considered the most likely source rock.

The oil produced is remarkable in the absence of light products, the low asphalt content and the high paraffin content. Cracking has been used to increase the market value. Only two wells gave much gas, and that was 95–97% CO_2 and contained only a trace of combustible gas. There is widespread evidence of Pliocene and early Quaternary vulcanicity, which readily accounts for this high CO_2 content. The gas comes from great depths, and accumulates in the porous zone below the Keuper. The pressure is therefore secondary, and no doubt these gases have dispersed and degraded ancient oil accumulations almost completely. The associated water is fresh, indicating ready access to the surface. The oil is produced mainly as an oil–water emulsion, and production falls off rapidly at first until a steady low rate is reached.

Only in the Bastard area are the data sufficiently complete to give the structure with fair certainty, and a stratum contour map has been drawn. In other areas several structural interpretations are possible. Transverse bulges, with a N.–S. trend, on the main folds have been important in determining the localization of oil.

The evidence was such as to make the discovery of large oil accumulations improbable in the Gabian area, but some worth while structures might occur. From 1924 to 1931, 57 wells were drilled. The production was declining in 1930, and to Nov. 1st, 1934, the recovery at Gabian was 24,204,500 litres of oil. Likely new areas for exploration are indicated, and several maps and sections are included. G. D. H.

553.982 : 553 (914.36)

15. Austrian Petroleum Operations in 1934. Anon. *Petr. Z.*, 24.7.35, **31** (30), 6; 2.10.35, **31** (39).—Particulars are given of wells drilled and being drilled and of the various interests operating in the country. S. E. C.

Drilling.

622.245.33

16. Fibrous Material in Cement and Drilling Fluids. C. P. Parsons. *Petr. Eng.*, Nov. 1935, **7** (11), 30.—Loss of circulating fluids or cement slurry into formations has been considerably reduced by the recent work that has been carried out on the value of the addition of fibrous materials to fluids and slurries.

In a large number of instances wells which have caused trouble from low-pressure formations have been completely controlled by using drilling fluid or cement to which has been added some fibrous material.

In one instance where the drilling fluid was found to be oozing from a crack several hundred feet below the well, one ton of fibrous material was added to the 9 lb./gal. mud in the circulating pit. When the mixture was pumped into the well there was a loss of only 6 inches of mud in the circulating pit during the time the seal was being obtained.

A similar result has been obtained with fibrous cement for cementing wells with formations which are capable of accepting the cement, thus preventing a perfect seal from being made. L. V. W. C.

622.245.33

17. Mud Resistance is Cut by Substituting Full-Hole Tool Joints for Regular. R. A. March and W. E. Gilbert. *Oil & Gas J.*, 14.11.35, **34** (26), 49.—Although the full-hole tool joint has been generally accepted as an improvement over the regular joint, more definite information is desirable for determining the actual economies which may be realized. The results of tests conducted to obtain comparable flow data under average field conditions are presented, and show that resistances may be materially reduced, pumping pressures and power costs lowered and circulation increased by the use of full-hole joints. L. V. W. C.

622.245.33

18. Viscosity Characteristics of Chemically Doctored Drilling Fluid. C. A. Andrews. *J.I.P.T.*, 1935, **21**, 963–981.—A paper giving (i) a discussion on the viscometric problems involved in the structure and flow characteristics of thixotropic mixtures with special reference to rotary muds, and (ii) concentration–viscosity curves of kaolin–water mixtures " doctored " with electrolytes that are of value in connection with the control of the viscosity of a drilling fluid in practice. G. R. N.

622.24

19. Drilling in Borneo. M. Naritimi. *Oil Weekly*, 14.10.35, **79** (5), 31.—The gas produced from the wells being drilled in Borneo can be utilized during drilling, but whilst it may be backed by very high pressure, it is too unstable to use for certain purposes.

In one well a gas-sand was penetrated that yielded a strong flow of gas which blew out the string of tools. It was observed that if the 8·5/8-in. casing was lowered to the bottom with its own full weight, the gas came upwards between the 10¾-in. and 8·5/8-in. casing. If the casing was supported on the surface with slips, one stroke of the bit on the bottom would permit the gas to flow up into the 8·5/8-in. casing. Due to this it was decided to leave the full weight of the casing on bottom without support from the derrick floor. As a result as hole was made the casing lowered itself, and was landed at 445 metres.

The rotary system was then used, a viscous mud was selected, and the casing-head pressure was held at about 45 kg./sq. cm. to balance the column weight of mud inside the casing.

A 6·5/8-in. casing was cemented at 852 metres, the two casing-heads were connected with each other under 35 kg./sq. cm. pressure and the gas from the well was utilized for boiler fuel.

At two other wells, due to the failure of the steam power, two strings of drill-pipe were in danger of freezing. One string of pipe was raised into the casing and packed under pressure, but insufficient steam remained to enable the other string to be raised. As a result 100 metres of 6·5/8-in. drill-pipe froze. No fishing tools being available,

it was necessary to fix the boiler temporarily and to pull and circulate the mud. After considerable work the well was closed and left. On resuming, the accumulated gas and mud blew up with great pressure and the frozen pipe was recovered with 160,000 lb. pull.

Cementing casing in a high-pressure well was practised, and a sketch is given to describe this operation. L. V. W. C.

622.24

20. Mississippi Delta Drilling Practices. B. Mills. *Oil Weekly*, 21.10.35, **79** (6), 38.—The discovery of the Garden Island Bayfield, which is located on silty land almost 100 miles below New Orleans, is a distinct contribution to geophysical and drilling progress.

Drilling is conducted under a severe handicap, as most of the land is covered with a silty mud, making it difficult to lay any type of satisfactory foundation on the surface.

Thirteen wells were drilled before oil production was developed, and the majority of these wells were drilled in on steel barges, which were sunk over the location and provided satisfactory well foundations in the shifting silt.

The first 1000 ft. of formations present many difficulties, due to the entry of shale into the hole. A number of strings were required to prevent this caving, and as a result casing represents a large fraction of the total well cost in this field.

Pipe-line outlets of any considerable length are not necessary, as oil barges can convey the oil to the ocean-going tankers all the year round. L. V. W. C.

622.24

21. Swampy Area Deep Drilling. B. Mills. *Oil Weekly*, 11.11.35, **79** (9), 48.—The Bayou St. Dennis field ranks as one of the deepest commercial oil-fields in the world, yielding clean oil from a depth of 9600 ft.

The structure was discovered by the Texas Company in 1934, and indicated and mapped with reflection seismograph. The marshy condition of the area greatly handicapped the geophysical crew.

The formations are as near ideal as could be expected in such a deep producing area, and the amount of open hole that can be carried and the ease with which the formations are drilled are prominent factors in the rapid drilling of the wells.

As much as 8500 ft. of open hole has been carried below the surface casing string, and drilling costs are accordingly reduced.

Mats and barges have been used as foundations, and the real problem here is the provision of suitable foundations.

The oil is moved by barge at present, but a line is under consideration.

L. V. W. C.

622.243.414

22. Cable-Tool Drilling Standardized for Local Conditions. L. G. E. Bignell. *Oil & Gas J.*, 10.10.35, **34** (21), 28.—As a means of successfully penetrating quicksand, gypsum, cavey lime, salt beds and dolomite, the Texas Panhandle operators have standardized cable-tool drilling, so that all the casing but the flow string can be pulled when the well is completed.

All the casing strings are set but not cemented, and carried with mud at the back of the pipe and water inside to equalize the pressures. L. V. W. C.

622.243.5

23. Corrosion Fatigue of Drill-Pipe is Cut by the Chemical Treatment of Mud. F. N. Speller. *Oil & Gas J.*, 14.11.35, **34** (26), 71.—Protection from transverse scoring on the outside of the drill-pipe will minimize corrosion or corrosion fatigue, and any openings at the joints should be sealed by fusion welding. Changes of velocity and contact effects at the joints should be avoided as far as possible, and the maintenance of the mud in stable colloidal form will protect the metal against corrosion. Where any materials are met that prevent satisfactory mud conditioning, the useful life of the metal under corrosion fatigue may probably be increased by the reduction of free oxygen with an excess of sodium sulphite. To reduce the rate of solution of oxygen

from the atmosphere, the mud should be caused to flow at the surface with the least amount of agitation in contact with the air. L. V. W. C.

622.243.5

24. Evaluation of Rotary Drilling Lines. K. N. Saatjian and V. V. Mason. *Oil Weekly*, 18.11.35, **79** (10), 19; *Oil & Gas J.*, 21.11.35, **34** (27), 41.—An endeavour has been made to develop a standard method for evaluating wire-rope service. A formula is presented, together with an alignment chart, for determining the work done by drilling lines in terms of ton-miles.

Safety methods, line speed, loading and methods of attaching rope to drums, drum sizes and lubrication are discussed.

Various charts are included to show graphically the service due to drill-pipe movements whilst drilling, and providing a method whereby rotary drilling lines may be retired from service as based on the amount of wear and number of broken wires. L. V. W. C.

622.245.1

25. Correct Setting Depth for Well Casing. T. M. Jasper. *Oil & Gas J.*, 14.11.35, **34** (26), 81.—The importance of higher compression yield strength in the transverse direction and higher tension yield strength in the longitudinal direction is stressed, and the correct setting depth values are indicated in a chart based on mathematical analysis and corroborated by a large number of practical tests. L. V. W. C.

622.245.334

26. Heaving Shale Conquered. E. S. Post. *Oil Weekly*, 18.11.35, **79** (10), 46.—Heaving shale problems have been successfully overcome in a number of wells by mud and engineering experiments.

Properly conditioned mud has been used with success in a number of instances, whilst in others the shale has been controlled by mechanics.

The equipment used by the Continental Oil Company includes three mud pumps compounded, double draw-works, and double engines, hydraulic rotary and a number of usual devices to insure continuous operation and to provide pulling and pump power when needed.

After setting 11¾-in. casing at 6073 ft. a special type of 8¾-in. extreme line casing drill-pipe was used for drilling the hole in one well and a collapsible wire line bit was run.

At another well similar equipment was used, but in addition a circulation valve was added to the drilling string. The chief function of this valve is to provide continuous circulation during every moment of drilling, or during the time when circulation would normally be idle. Valves were placed on every double run. The valve has a side opening, which can be connected to the hose pipe and mud pumped down the string whilst a new piece is being attached to the string. L. V. W. C.

628.112.2

27. Shallow Water-Bearing Sands Provide Supply for Lea County. L. G. E. Bignell. *Oil & Gas J.*, 14.11.35, **34** (26), 36.—The annual rainfall in Lea County, New Mexico, is only about 14 in., but fortunately abundant good water is available at depths from 50 to 125 ft. from the surface. The water is used for irrigation purposes, domestic water supply, and lately has been developed for drilling purposes. A number of the wells drilled are operated by rod lines from a central power plant, whilst the others are individually operated. L. V. W. C.

622.243 : 608.3

28. Patents on Drilling Plant. W. G. Brewster. U.S.P. 2,018,007, 22.10.35. Side-tracking tool.

G. Syabo. U.S.P. 2,018,194, 22.10.35. Oil and gas well capping device.

J. K. Oksenholt. U.S.P. 2,018,414, 22.10.35. Core barrel retriever.

J. Grant. U.S.P. 2,019,047, 29.10.35. Hydraulic and spring-operated expansive reamer. L. V. W. C.

Production.

532.542 : 622.276

29. Energy Relation in a Flowing Well. B. H. Sage and W. N. Lacey. *Oil Weekly*, 18.11.35, **79** (10), 31; *Oil & Gas J.*, 21.11.35, **34** (27), 38.—A knowledge of the properties of fluids flowing through pipes or porous media is of primary importance if the problems arising are to be attacked. Where the properties of the fluids undergo large changes during the flowing process, these properties must be known over the ranges of conditions which may be encountered in service.

The method of attack on the problem will determine the properties to be measured. Such properties as specific volume, heat content and entropy as functions of pressure and temperature throughout the range of conditions likely to be met with in practice appear to be the most useful.

Experimental results for a particular case are presented, indicating how they may be used to analyse the energy relations involved in flow through the tubing of a producing well. L. V. W. C.

553.982

30. Estimation of Reserves in Practical Limestone Fluids. P. P. Gregory. *Oil Weekly*, 21.10.35, **79** (6), 33.—Owing to the peculiar character of the limestone reservoir lacking the uniformity of porosity and permeability found in sand fields, no positive methods of estimation of reserves are available.

Large errors may result from production based on recoveries obtained in assumed similar older limestone fields.

From experimental data it is possible to state that in fields under volumetric control, Coleman's formula may be used to obtain reliable estimates of the amount of oil originally present in the reservoir, provided the average gas–oil ratio can be closely controlled. If such control is lacking, an estimate can be made from the analysis of total recovery of fluids and corresponding decline in the average reservoir pressure.

In reservoirs producing in hydraulic control, estimation can be made from a study of the withdrawals and the rise of the oil–water contact, together with changes in extent of the gas cap. L. V. W. C.

553.982

31. Production Decline Curve of Oil Wells may be Extrapolated by Loss Ratio. S. J. Pirson. *Oil & Gas J.*, 14.11.35, **34** (26), 34.—The author shows that the "Loss Ratio Method of Extrapolation" for estimating the future life of underground reservoirs has a decided superiority over the other methods, since no simple law of variation with time is assumed for the decline of the yield of oil wells. The application of this law does not require complicated computations of constants, and the only assumption made is that the conditions of production are constant or varying in a continuous manner. L. V. W. C.

622.276

32. Oil-sands as Well as Lime Formations Respond to Proper Acid Treatment. F. B. Plummer and R. B. Newcome. *Oil & Gas J.*, 24.10.35, **34** (23), 44.—This article outlines a description of the complete laboratory procedure for testing cores preparatory to acid treatment.

From the results obtained it appears that the method of treating each well is a separate problem. The kind of rock, the texture of the oil-sands and the nature of the oil are important characters that may affect markedly the success of an acid programme.

If the limestone is fine grained and impure, the insoluble residue dissolved from the core by the acid is in granules, and minute acicular crystals larger than the pore spaces in the rocks. This material will thus clog the core and decrease permeability, no matter how much washing or swabbing is done to clear it. L. V. W. C.

622.276

33. Auxiliary Gas Trap. F. Swindell. *Oil Weekly*, 21.10.35, **79** (6), 17.—The combination of high-bottom-hole pressure and large volumes of gas makes necessary

the use of high-pressure surface-equipment of large volumetric capacity, and capable of withstanding the cutting action of sand in the stream.

With the decline in pressure to about 400 lb./sq. in. it is necessary to adapt the available equipment to present conditions, and wells must now be produced at or as near atmospheric pressure as possible, and one company is using an auxiliary trap to the large separators.

The auxiliary trap comprises a tank with a float installed inside which actuates a snap acting pilot. When the fluid level has reached a low point in the receiver, the pilot acts to cause the float to snap into a low position, and in an opposite position as the level rises.

Arrangement of the trap is such that it permits lowering of back pressure on the separator or the carrying of the highest possible vacuum without affecting its operation.

L. V. W. C.

622.276

34. Water-Flood Practices. J. C. Albright. *Oil Weekly*, 11.11.35, **79** (9), 31.—The cost of flooding a property with water can be better estimated after coring has been carried out. Redrilling a flood property is becoming more general as more information is accessible, and the "five-spot" plan is assumed to result in greater returns than any other method of production. In certain cases "delayed flooding" is carried out.

In the majority of cases the water wells and producers are drilled in exactly the same manner. In the producing wells small-diameter casing is set on the shales, but in the water wells tubing is run into the hole with a packer placed so that it will hold just above the oil zone, and this is cemented. Thus the tubing becomes a fixture, and is permanently sealed from both above and below the point where it is set.

The amount of water that a given intake well will receive depends on the permeability of the sand and the pressures available. In the five-spot plan the water drives the oil from the sand surrounding the intake wells to the centrally located oil producer.

L. V. W. C.

622.276

35. Modern Controlled Water Flooding in Oklahoma. L. H. Towers. *Petr. Eng.*, Nov. 1935, **7** (11), 27.—Water flooding has recently been started in the Oklahoma field, and the delayed five-spot plan has been adopted. All old wells are abandoned and new water wells are drilled at equal intervals over the whole lease, and the oil wells drilled in the centre of each set of four wells. The wells in this field are 330 ft. apart, so that each oil well drilled will be in the centre of a 2½-acre tract.

No oil well is drilled until sufficient pressure has been built up in the sand, and this may take from 45 to 75 days.

The most modern methods for ensuring a supply of good water are being used in this field, and an elaborate treating plant has been erected for this purpose.

L. V. W. C.

622.276.2

36. Subsurface Pressure Surveys Factor of Value in Oil and Gas Production. W. H. Osgood. *Oil & Gas J.*, 7.11.35, **34** (25), 135.—Subsurface pressure recorders enable the bottom-hole and intermediate pressure to be measured directly whether the well is flowing or not, and where these are run on a measuring line precise depth measurements are possible. The ability of a reservoir to supply oil depends first on the reservoir pressure which is taken as the mean or mid-perforation pressure, or possibly as the bottom-hole pressure after the well has been closed in long enough to allow these pressures to approximate the value of the reservoir pressure.

More accurate figures, showing the well's capacity to produce, can be arrived at by basing the calculation on the formation volume withdrawn rather than on the productivity index, which is a measure of the reservoir's permeability.

L. V. W. C.

622.276.4

37. Economics of Pumping. B. H. Robinson. *Oil Weekly*, 18.11.35, **79** (10), 39; *Oil & Gas J.*, 14.11.35, **34** (26), 43.—Although proration plans sometimes have adverse

effects on ultimate recovery, it is generally necessary to pump at the maximum practicable rate.

It is possible to secure maximum production by the use of deep tubing, adequate pump capacity, elimination of free gas from the pump and low casing-head pressure.

Minimum lifting cost is secured by a suitable pumping machine, which must be adequately strong, flexible in speed and of high efficiency, subsurface equipment and methods of operation which require a minimum of servicing expense and power economy and use of prime movements suitable for the location. L. V. W. C.

622.276.95

38. Handling Small Production of Gas Lift. S. F. Shaw. *Petr. Eng.*, October 1935, **7** (1), 25.—With a decline in natural flow in the Oklahoma City field, wells were placed on gas lift and the question of operating expenses had to be considered.

A number of small producers are still flowing naturally, but gas–oil ratios are high, and this method of production is naturally the least expensive.

Small producers operating under continuous gas lift are unable, in the main, to produce profitably by this method, unless compressed gas is available at a reasonable price.

When the production of a well has fallen to some point between 200 and 300 brl. per day, it is possible to increase production by placing them on intermittent flow. Not only is production increased, but the quantity of input gas is also reduced by 25 to 50%.

Prevailing conditions regulate the quantity of input gas, and the cycle per flow is adjusted to the potential of the well.

For intermitting through the casing, pressures of about 500 lb./sq. in. are required, but lower pressures will be possible if the well is completed with large-size casing and tubing is employed. L. V. W. C.

622.276.95

39. Handling Small Production by Gas Lift. Part 2. S. F. Shaw. *Petr. Eng.*, Nov. 1935, **7** (11), 51.—When wells in the Oklahoma City field have declined to the capacity at which intermitting becomes acceptable, intermitting through the tubing with plunger has been successful. The capacity of the well depends on the flowing pressures at the bottom of the well when intermitting through tubing—and the capacity of tubing for a given flowing pressure will vary with the length of the pipe—on the quantity of water mixed with the oil, on the temperatures of the gas and on the gravity of the oil. No fixed figure can therefore be given for capacity.

Prevention of paraffin deposits in the tubing and casing has been obtained by the use of chemicals, but apparently large quantities of casing-head gasoline or of distillates are more satisfactory than small quantities of these specially prepared chemicals.

It has been found that the lifting of oil in small quantities, especially when pressures are high, contributes to favourable conditions and prolongs the length of time when such methods meet with favourable conditions. L. V. W. C.

622.276 : 608.3

40. Patents on Production Apparatus. R. J. Anschicks. U.S.P. 2,017,837, 22.10.35. Closure apparatus for the filler opening of a gas tank.

R. H. Carr and H. C. Humphrey. U.S.P. 2,018,199, 22.10.35. Balanced pressure method for introducing acid reagents into oil wells.

S. Evans and H. B. Woods. U.S.P. 2,018,204, 29.10.35. Plunger for plunger lift.

S. Evans. U.S.P. 2,018,205, 22.10.35. Plunger for plunger lift.

H. W. Fletcher. U.S.P. 2,018,206, 22.10.35. Apparatus for plunger lift control.

L. W. Blau. U.S.P. 2,018,700, 29.10.35. Well pumping device.

W. E. Lang. U.S.P. 2,019,418, 29.10.35. Method and apparatus for recovering from oil-sands by repressuring. L. V. W. C.

Pipe-Lines.

622.698

41. Calculations for and Methods of Design for Slide Rule for Use in Oil Pipe-line Problems. L. V. W. Clark, R. Fallah and A. W. Nash. *Petr. Eng.*, October 1935,

7 (1), 51.—The calculations necessary for the computation of an equation for pipe-line problems and the methods of design of a slide rule for the quick determination of the equation are explained. L. V. W. C.

622.698

42. Electric Pipe-line Drainage a Practical Alternative to Reconditioning Pipe. G. T. Rhodes. *Oil & Gas J.*, 24.10.35, **34** (23), 130.—Cathodic protection is a practical method of saving badly corroded lines where the alternative is reconditioning.

The corrosion of most pipe-lines is caused by stray electric currents arising from chemical differences in and along the pipe. Currents will be found to flow out of a length of clean steel, which has been connected to a length of steel coated with mill scale or rust, into the soil, thus corroding the clean steel, and then into the mill scale, where no corrosion will take place. Even when only clean steel is buried, the chemical nature of the soils may be so variable that a voltage difference exceeding 0·3 volt will be shown, and if the two pieces are connected, currents will flow which will cause one or other of the pieces to be corroded.

If the short-circuited galvanic couples on the pipe are depressed in electric pressure with respect to the soil itself, the residual voltage causing currents to flow from the pipe to the soil will be reduced. With sufficient depression the direction of the current may be reversed. This depression can be brought about by connecting the pipe to the negative terminal of some direct-current electric generator and the positive of this generator to earth. L. V. W. C.

622.698

43. City Plant Line Losses. R. W. Parker. *Petr. Eng.*, Nov. 1935, **7** (11), 40.—Leakage in pipe-line systems amounts to billions of cubic feet of gas annually, and the sources of leakage are more numerous in a distribution plant than in any other part of the system, owing to the greater number of fittings installed.

Systematic surveys are carried out to ascertain distribution leakages, and maps showing gas-lines as well as telegraph, telephone and electric lines should be prepared.

The most common methods and tests are the bar hole and flame, soapsuds testing, the use of stenches, a leak detector, pressure drop, metering-in and metering-out.

Odorization is commonly used to detect leakage, and although it does not do away with leakage inspections, it is of great assistance in locating the leaks quickly.

Soil corrosion is a serious factor which must be considered in leakage surveys. A chemical analysis of the soil is made and the electrical conductivity or resistivity is recorded. The type of soil will indicate generally the life of the line or when and where losses should be expected. L. V. W. C.

622.698

44. Line-Crossing Dangers. F. B. Taylor. *Oil Weekly*, 11.11.35, **79** (9), 51.—Quicksands have caused oil and gas pipe-line companies in Texas Panhandle further to secure their gathering and lateral line crossings. The problems arising from shifting channels, caving of banks and the movement of quicksands have been correctly defined and overcome.

In quicksands the pipe is sunk to bed rock and the line then supported on cross piping. Any shifting of the sand-bed would thus not leave the pipe hanging, and the support affords adequate protection at high-water levels. A spudding machine is used to make the necessary holes. These holes are cased with 6-in. pipe perforated at the bottom, and concrete is poured in, which finds its way through the perforations to form a binding with the rock. Two holes are drilled opposite each other, and when completed a supporting saddle is placed beneath the pipe-line. L. V. W. C.

622.698

45. Methods of Handling Scrapers in Waxy Crude Lines. J. H. Wood, Jr. *Oil & Gas J.*, 24.10.35, **34** (23), 25.—The general practice for cleaning pipe-lines has been to introduce a go-devil into the line after the pressure has been relieved, but, due to the possibility of shutting a valve against pump pressure, a new method and apparatus have been developed.

A Y branch with valve is introduced into the discharge outlet of the pump. To this branch is attached a nipple capped by a bull-plug held in place by a victaulic coupling. The bull plug is provided with a gland through which a piston rod is run carrying a piston. This piston is used to force the scraper into the line by means of a winch and cable.

When it is necessary to use a scraper the tool is placed in the Y branch and the piston forced down on top of it until the scraper reaches the main-line flow. The piston is then removed and the valve in the branch closed. No reduction of pressure results, and the tool is carried through the line by the liquid flowing.

L. V. W. C.

622.698 : 620.192

46. Internal Corrosion of Sour Crude Oil Pipe-lines Presents Serious Problem. W. F. Rogers. *Oil & Gas J.*, 24.10.35, **34** (23), 69.—Pipe-line equipment suffers from rapid internal corrosion when sour crude oil is handled. Eight years is a maximum average service life for lines handling sulphide crudes, but internal corrosion of main trunk lines is not as rapid as that of gathering lines. Pipe-line station manifolds and suction lines will have an average service approaching 10 years.

This internal corrosion attack can be reduced or stopped by removing either or both the hydrogen sulphide or the water from the crude oil.

If possible, all air should be kept from the sulphide-bearing oil by vapour-tight lease equipment and tight pipe-line storage tanks.

Cement-lined pipe is recommended as a corrosion-resistant pipe for gathering and suction lines. L. V. W. C.

622.698 : 620.191

47. Determination of Corrosion on Underground Pipe-lines. O. C. Mudd and G. C. Gabler. *Oil & Gas J.*, 24.10.35, **34** (23), 54.—Mitigation of corrosion on underground pipe-lines by cathodic protection is practical, and the degree to which this protection is to be carried depends on the economic returns to be realized.

Cost and reliability will regulate the methods of providing cathodic protection, and where power from sources of mechanical generation is not available, the installation of zinc anodes offers the most practical solution to date. L. V. W. C.

622.698 : 620.197

48. Development of Specifications for Protection of Underground Pipes. K. H. Logan. *Ind. Eng. Chem.*, 1935, **27**, 1354.—The results of recent investigations on the efficacy of pipe coatings are summarized and the essential requirements for such coatings given. The effects of stray currents cannot be entirely eliminated by coatings, and insulating layers, although reducing electrical effects and total corrosion, may accelerate local pitting where the pipe is anodic to the earth. None of the coatings examined had a perfect record after a 4 years' exposure to soil action, but the effectiveness of the coating increases with increase in thickness. The chief causes of failures of coatings are : improper application, injury to the coating and deterioration of its constituents. Thin coatings (paints, etc.) afford inadequate protection, non-bituminous paints tending to become brittle on exposure to soil. Bituminous enamels are more liable to distort, due to soil pressure and shrinkage, than reinforced or fabric-wrapped bituminous coatings, and coal-tar pitch absorbs less moisture than petroleum asphalt. The relative behaviour of various coatings is not the same for different soils. Since the penetration time–corrosion curve is parabolic or hyperbolic for many soils, an increase in pipe-wall thickness frequently results in a more than proportional increase in pipe life. Thus, it may be more economical to increase serviceability by the use of extra-heavy pipe than by applying suitable coatings to standard or thin-walled pipe. Non-bituminous (*e.g.* cement or metallic) coatings are still in the development stage. The requirements for an adequate coating are : (1) resistance to mechanical shock ; (2) non-flowing under moderate pressures over long periods ; (3) relatively high electrical resistance ; (4) non-deterioration with age and exposure to soil conditions ; (5) good adhesion under strains and stresses between pipe and coating ; (6) ease of application ; (7) non-susceptibility to temperature change and non-evolution of fumes. W. H. T.

622.698 : 620.197.5

49. Experiences and Developments on Electrical Protection of Pipe-lines. S. Thayer. *Oil & Gas J.*, 24.10.35, **34** (23), 120.—The causes of pipe corrosion are generally assumed to be electro-chemical—that is, the chemical action between the pipe and the soil causes small currents of electricity to be generated. These currents cause pitting of the pipe whenever they pass from the pipe into the surrounding soil.

The only method for preventing the movement of these strong currents is to have a current entering the pipe at all places on the surface. A stronger force must therefore be used to pump current on to the surface of the pipe than any force which might be discharging current from the pipe.

A direct-current line must be available. The negative end of this power is attached to the pipe, and the positive to a mass of iron which is placed in the ground. When the power is turned on, current is forced from the metal scrap into the soil, thence to the pipe wall and back to the power supply. Pressure of a sufficient intensity to overcome the pressure tending to cause the current to flow from the pipe must be supplied. L. V. W. C.

622.698 : 620.197.6

50. Deterioration of Fabrics for Pipe-lines. G. N. Scott and S. Ewing. *Oil & Gas J.*, 24.10.35, **34** (23), 112.—A number of fabrics used for pipe-line protection have been put to various tests to determine their suitability for this work. These fabrics were directly exposed on both sides to the attack of bacteria and fungi in a soil which was full of partly decomposed organic matter, and which was near the optimum moisture content and temperature for the rapid growth of these organisms. These conditions were such that the fabrics would be expected to deteriorate much more rapidly than they would on a pipe-line.

These tests afford some measure of the relative stability of the fabrics.

It was found that exposure to the soil caused a decrease in the strengths of all of them except woven asbestos fabric. All the asbestos felts were less affected than any other material.

Even the use of creosote tar and other disinfectants does not completely prevent rotting. There is little to choose between asphalt and coal-tar as a saturant for rag felts. L. V. W. C.

Crude Petroleum.

665.51

51. The "Base" of a Crude Oil. E. C. Lane and E. I. Garton. *Petr. Times*, 1935, **34**, 429, 455; U.S.B.M., R.I., 3279.—The conventional classification of crude oil into paraffin base, asphaltic base, intermediate base, etc., types has been extended to permit of more accurate designation. The basis of the new classification is the boiling-point/gravity curve as determined by the United States Bureau of Mines Hempel Method of distillation. Distillation is carried out at atmospheric pressure up to 275° C. and continued at 40 mm. (abs.) pressure. Then, according to the gravity of the 250–275° C. (atmospheric pressure) fraction and the 275–300° C. (40 mm. pressure) fraction, so is the particular crude classified. The scheme comprises nine possible crude oils.

1. Paraffin base. Distillates paraffinic throughout. 2. Paraffin-intermediate base. Light fractions paraffinic, heavy fraction intermediate. 3. Intermediate-paraffin base. Light fractions intermediate, heavy fractions paraffinic. 4. Intermediate base. Fractions intermediate throughout. 5. Intermediate-naphthene base. Light fractions intermediate, heavy fractions naphthenic. 6. Naphthene-intermediate base. Light fractions naphthenic, heavy fractions intermediate. 7. Naphthene base. Fractions naphthenic throughout. 8. Paraffin-naphthene base. Light fractions paraffinic, heavy fractions naphthenic. 9. Naphthene–paraffin base. Light fractions naphthenic, heavy fractions paraffinic. An example shows how a crude is classified. If the A.P.I. gravity of the 250–275° C. (No. 1 Key fraction) is 40·0°, or lighter, the light fractions are paraffinic, if 33° or heavier they are naphthenic, and if between 40° and 33° they are intermediate. The system may be further extended by qualifying particular crudes according to their wax contents as indicated

by the cloud point thus: paraffin base, wax bearing; naphthene base, wax-free. The distillation data of a number of crudes are published to illustrate the working of the scheme. H. G.

665.514

52. **Treating Crude Oil Emulsions.** H. K. Ihrig. *Oil & Gas J.*, 7.11.35, **34** (25), 49.—The treating of crude oil emulsions in the Seminole area of Oklahoma is accomplished at a minimum of expense. Treating plants vary in size, capacity, efficiency and initial cost, and several methods of computing costs are being used. The vapour pressuring of stock tanks, the handling of tank bottoms and the various kinds of treating equipment used in the field are discussed. L. V. W. C.

Chemistry of Petroleum.

547.21 : 532.13

53. **Viscosity of Aliphatic Hydrocarbon Solutions.** K. N. Meyer. *Helv. Chim. Acta*, 1935, **18**, 1067.—In connection with the viscosity of solutions of aliphatic hydrocarbons in carbon tetrachloride, it is shown that the relation between specific viscosity and the number of carbon atoms (π) in the chain, at constant concentration, is $\eta_{sp.} \times 10^3 = 195{\cdot}6\pi - 1421$. With increasing values for π, this equation approaches Staudinger's $\eta_{sp.n \to \infty} = 195{\cdot}6\pi$. It is concluded that specific refraction is a qualitative measure for the size of the dissolved particles, but that for quantitative purposes, thermodynamical methods yield better results than the viscometer method. Results obtained with *iso*- and cyclic paraffins show that specific refraction is not a function of chain length, but that structure has an important, although complicated, influence. P. C. K.

547.21 : 542.943

54. **Ozone as an Oxidation Catalyst.** E. Briner and J. Carceller. *Helv. Chim. Acta*, 1935, **18**, 973.—The article deals with the oxidation of saturated hydrocarbons (*e.g.* C_3H_8 and C_4H_{10}) at various temperatures. Below 150° C., the effect of oxygen is negligible, but ozone brings about considerable oxidation with the formation of aldehydes and acids. At certain temperatures, an abundant production of liquid compounds is observed, consisting mainly of aldehydes, acids and peroxides. P. C. K.

547.21 : 543

55. **Specific Refraction as a Means of Predicting the Composition of Saturated Synthetic Hydrocarbon Mixtures.** H. I. Waterman and J. J. Leendertse. *Rec. Trav. Chim.*, **54**, 725, 1935.—Specific refractivity has already proved to be a trustworthy constant in calculating the ultimate analysis of mixtures of natural hydrocarbons with a high molecular weight, cyclic or partly cyclic in structure.

With low molecular weight polymerization products obtained from unsaturated hydrocarbons a rather ramified structure of the polymer products may be expected. Moreover, the special structure of these products may influence the specific refractivity. The results of a vast number of experiments and determinations prove that the carbon–hydrogen ratio of completely hydrogenated polymerization products can be predicted from the specific refractivity. P. C. K.

547.213 : 542.943

56. **Mechanism of the Slow Oxidation of Propane.** R. N. Pease. *J.A.C.S.*, 1935, **57**, 2296–2299.—Mixtures of oxygen (10–30% by volume) and propane were passed through a heated reaction tube at 260° C. and 300° C. The reaction tube was of Pyrex glass and coated with potassium chloride. The products of the reaction were quantitatively examined and the indicated stoicheiometric equation was found to be

$$C_3H_8 + 2O_2 \rightarrow CH_3OH + HCHO + CO + H_2O$$

The primary products of the slow oxidation are thus as printed.

The author discusses various theories of combustion, and concludes that Rice's radical chain theory offers the best interpretation of the results on the assumption

that methoxyl and propyl are the chain carriers. Similar mechanisms, it is pointed out, involving hydroxyl in place of methoxyl, and producing water, in place of methanol, may apply to the oxidation of methane and ethane. W. E. J. B.

547.269.2

57. Reaction Between Sulphur Dioxide and Olefins. III. L. L. Ryder and C. S. Marvel. *J.A.C.S.*, 1935, **57**, 2311–2314.—Polysulphones have been obtained by the combination of sulphur dioxide and methylpropene, 1-pentene, 2-pentene, 1-nonene, etc. These polysulphones are neutral products of molecular weights in the range 100,000–200,000. W. E. J. B.

547.313.2 : 542.952.6

58. Polymerization of Ethylene. V. N. Ipatieff and H. Pines. *Ind. Eng. Chem.*, 1935, **27**, 1364.—Detailed experiments are described concerning the polymerization of ethylene at 250–330° C. and 50–65 atm. pressure in the presence of phosphoric acid. The liquid polymers produced are mixtures of paraffinic, olefinic, naphthenic and aromatic hydrocarbons. The concentration of paraffins is greatest in the lowest-boiling fractions; the aromatics, on the other hand, appear in the fractions distilling at 225° C. and higher. Unsaturated compounds are present with one exception in all fractions; no olefinic hydrocarbons were found in the product boiling below 60° C. obtained by polymerization at 330° C. Naphthenic hydrocarbons are present in fractions boiling above 110° C. Under the polymerization conditions examined, *iso*butane is an important product, amounting to 2·5% of the ethylene reacting at 250° C., and to 18·8% of the ethylene reacting at 330° C. The difference between the polymerization of ethylene in the presence and absence of phosphoric acid consists in the presence of aromatic and paraffin hydrocarbons in the former, whereas no traces of aromatics, and only small quantities of paraffin, were found in the latter. In comparison with catalytic polymerization, thermal polymerization gives higher-boiling products.

Regarding the mechanism of the reaction, the first step is the formation of ethyl phosphates, which, being unstable, decompose to give ethylene polymers and naphthenes. These may dehydrogenate to give aromatics, while the ethylene polymers may hydrogenate to form paraffins. D. A. H.

547.313.5 : 542.952.6

59. Polymerization Products of Normal 2-Pentene at High Temperature. H. I. Waterman, J. J. Leendertse and J. de Hulster. *J.I.P.T.*, 1935, **21**, 952–958.—An account of experiments on the action of hydrogen with or without a nickel catalyst and the latter alone at various temperatures on a polymerization product obtained by treating normal 2-pentene with aluminium chloride at 0° C. G. R. N.

547.677.2

60. Synthesis of Phenanthrene. L. F. Fieser and E. B. Herschberg. *J.A.C.S.*, 1935, **57**, 2192–2196.—A new synthesis of phenanthrene has been developed which in its simplest form involves the following steps: (1) the preparation of γ-phenylbutyric ester, (2) condensation with oxalic ester, (3) cyclization to the anhydride of 3 : 4-dihydronaphthalene 1 : 2-dicarboxylic acid, (4) addition of butadiene, (5) decarboxylation by fusion with alkali, (6) dehydrogenation. W. E. J. B.

547.682

61. Cholanthrene and Related Hydrocarbons. L. F. Fieser and A. M. Seligman. *J.A.C.S.*, 1935, **57**, 2174–2176.—Cholanthrene and three additional hydrocarbons of the 1 : 2-benzanthracene series have been prepared by the modified Elbs synthesis. W. E. J. B.

665.521.1 : 66.095.2

62. Thermal Treatment of Gaseous Hydrocarbons. A. E. Dunstan, E. N. Hague and D. A. Howes. *Chim. et Ind.*, 1935, **34**, 373.—At 750–1100° C., all gaseous hydro-

carbons form liquid compounds consisting mainly of benzene, toluene, styrene and *m*- and *p*-xylene, together with butadiene, *cyclo*pentadiene and indene. The higher-boiling fractions contain naphthalene, anthracene, phenanthrene and chrysene. Ethane yields 60% and propane and butane 90–100% of ethylene hydrocarbons in one cracking operation. The advantages of polymerization and condensation over pyrogenetic decomposition are summarized, and it is shown that the motor fuel obtained by pyrogenetic decomposition has a higher anti-knock value than that yielded by the former processes. Polymerization was studied in three different ways. Using an autoclave at 380–410° C. with an initial pressure of 100 atm., a yield of 92% was obtained. With continuous apparatus fitted with a steel liner, carbon formation was observed, and by the use of a copper liner, an increase in temperature of 50–60° C. was required. The products of polymerization (sp. gr. 0·750–0·770) were straw yellow in colour and had 80–86% distilling below 200° C.

P. C. K.

665.534.6

63. Production of Cyclic Compounds by Destruction of Rangoon Paraffin at High Temperature. H. I. Waterman, J. J. Leendertse, L. Adam and C. van Vlodrop. *J.I.P.T.*, 1935, **21**, 959–962.—Experiments are described on the hydrogenation cracking of Rangoon paraffin with or without a nickel catalyst at high temperature, and indicating that according to the conditions of pyrolysis the cyclic character of the reaction products can be varied. G. R. N.

Refining and Refineries.

661.258

64. Acid Production from Waste Gases Containing H_2S. Anon. *Chem. Trade J.*, 8.11.35, **97**, 391.—A process for manufacturing sulphuric acid that has been devised and is being employed by two coke-oven plants in Germany is described in *Die Chemische Fabrik* of October 30th. The gas is burned with excess air to produce SO_2, the combustion gases are led over a contact mass where SO_2 is oxidized to SO_3, and the reaction gases led into a condenser in which the SO_3 combines with water from the combustion and oxidation reactions to form sulphuric acid.

The gases in the contact plant should preferably contain 4–7% by vol. of SO_2 and 5–8% by vol. of O_2, so a considerable excess of air is used in the combustion of H_2S. The temperature in the combustion chamber is usually 750–800° C. A minimum speed of passage through the burner is necessary to prevent backfiring, and a special gravel filter fitted just behind the burner has proved effective in avoiding backfiring due to unexpected stoppages. Where the H_2S content of the gas is low and the CO_2 content high, ovens lined with fireclay or filled with checkerwork are used to assist combustion. Organic impurities such as naphthalene, phenol, etc., are not harmful to the contact stage, as they burn to CO_2 and water, but dust must be removed.

A catalyst on the basis of tin dioxide and chromium oxide is effective in the contact stage, or a vanadium catalyst may be employed. Both are uninfluenced by water vapour. The contact apparatus resembles a vertical water-tube boiler. The vessel is jacketed, the jacket serving as a heating means for starting up and a cooling means later on. The gases are introduced at the conversion temperature, and cooling is effected by cold air led in counter current to the gas stream. The rate of cooling air is adjusted to suit variation in SO_2 content of the gases. The reaction temperature is 350–450° C., so that any sulphuric acid formed is completely dissociated into SO_3 and water vapour. Yields of acid of 98% have been obtained on the large scale. Gases from the contact apparatus are led at about 350° C. into a tube condenser, cooled by steam at atmospheric pressure. The dissociated acid combines and condenses and leaves at 80–100° C.

By suitable temperature regulation it is possible to condense fractionally to some extent, and so produce an acid of 86–90% strength, pure enough to use, after dilution, as accumulator acid.

Plants are in operation at Frankfort and in the Ruhr, both using waste gases from ammonium sulphate saturators, but it is stated that the process is applicable in the purification of coke-oven gases. The cost of acid production at the larger works (6 tons of 60° Bé. acid per day) is stated to be 2 Rm. per ton of 60° Bé. The process is covered by patents. R. A. E.

662.753.21

65. New Washing Column for Benzoles from Coke Ovens and Tar Distillation. E. Eming and J. F. Kesper. *Asphalt u. Teer*, 1935, **35**, 986–987.—Benzole is pumped to the bottom of a fairly narrow cylindrical vessel containing sulphuric acid. It enters the latter at the bottom in a fine stream with a rotary motion. Above this reaction chamber is a larger vessel in which the benzole collects, the rotary motion being broken up by horizontal partitions between the two vessels. Benzole is withdrawn from the top of the larger vessel and pumped back to the bottom of the acid-treating chamber. This apparatus gives greater control than ordinary acid-washing processes and uses a minimum amount of acid. C. C.

665.53

66. Octane Number Improvement in Naphtha Reforming. S. W. Turner and E. J. Le Roi. *Ind. Eng. Chem.*, 1935, **27**, 1347.—A correlation of plant cracking data has been effected which enables the octane number obtainable in reforming naphtha to be predicted in terms of the original octane number of the charge and the amount of cracking to which it is subjected. The amount of cracking is expressed in terms of equivalent seconds at 900° F. which are derivable from or convertible to an actual time–temperature curve, on the assumption that the cracking rate doubles with a rise in temperature of 25° F.

$$i.e. \quad \Theta_{900} = \int_1 \frac{T - 900}{25}\, d\theta,$$

where θ and T are co-ordinates of the time–temperature curve. It is shown by mathematical treatment that the octane number improvement of naphtha can be predicted and, for plant design purposes, the method can be worked backwards. W. H. T.

665.54 : 657.472

67. Costing of Petroleum Refinery Operations. G. Kerr. *J.I.P.T.*, 1935, **21**, 907–930.—A lecture with discussion outlining some principles involved in the determination of refinery costs, together with a review of the main classes of expenditure which determine these costs. G. R. N.

665.544

68. Wetted Surface in Ring-Packed Towers. F. Mayo, T. G. Hunter and A. W. Nash. *J.S.C.I.*, 1935, **54**, 375–385T.—This investigation describes experiments to determine the effect of the fluid flow and tower dimensions on the fraction of the total available packing surface wetted, and to obtain information regarding the fluid conditions in the packing which consisted of ring fillings stacked irregularly.

The rings were made of paper, and the wetting liquid was an aqueous solution of a water-soluble dye. From the dyed portions, which were cut out and weighed, as were also the undyed portions of the rings, the wetted and non-wetted areas could be determined. The results obtained are expressed graphically, but a rigid mathematical interpretation has not been attempted. Amongst the data found are the following qualitative facts: (1) the wall surface is proportionally more wetted than the packing; (2) the percentage of both ring and wall surface wetted decreases from top to bottom of the tower; (3) the wetting liquid as it flows down the tower tends to flow from the centre of the packing to the walls of the tower and thence down the walls; (4) about 10% of the actual wetted surface is inactive due to the formation of stagnant liquid pools; (5) the liquid hold-up is independent of the gas mass velocity, counter current up the tower, but increases as the wetting liquid mass velocity increases. Numerous other facts are noted. W. E. J. B.

665.54

69. Patents on Refinery Plant. Svenska Akt. Gas Accumulator. E.P. 430,877, 26.6.35. A burner for gaseous or vaporous fuel in which the latter is supplied on one side and combustion air on the other side of one or more perforated partitions so that the air penetrates into the fuel through the perforations for the combustion

of a corresponding quantity of the fuel. The total area of perforations turned towards air is less than the total area turned towards fuel.

Univ. Oil Prods. E.P. 437,543, 31.10.35. A pipe heater in which both sides of the tubes forming the radiant-heat bank are heated equally by direct radiation, convection heating being avoided. Higher rates of heat input are thus obtained, and hence less tube surface is required for the same amount of heating.

N. Saruchanoff. E.P. 437,706, 4.11.35. Apparatus for ascertaining the weight of the fluid contents of tanks. W. H. T.

Cracking.

665.54

70. Cracking Iraq Topped Crude. Anon. *Petr. Times*, 1935, **34**, 441.—A Dubbs unit for the cracking of this crude in France is described. The plant consists of a two-coil selective full-flashing cracking unit and a Dubbs reforming unit, both designed to produce stabilized end-point distillate. The topped crude, mixed with column reflux, is divided in the fractionating column into heavy and light feed for the appropriate furnaces. From the latter the oil passes to the reaction chamber and flash chamber, where the residuum is removed. Gas and vapours pass to the main fractionating column to provide lighter vapours, which pass on to the secondary fractionating column, and reflux for the heavy and light oil flashing coils. The light overhead fraction from the secondary column is stabilized. Exceptional flexibility is claimed for this type of plant. H. G.

665.54

71. New T.V.P. Experimental Unit Uses Tubular Heaters. N. Williams. *Oil & Gas J.*, 7.11.35, **34** (25), 38.—A 5-brl. experimental unit built by T.V.P. Corporation has been operating for 4 months on charging stocks ranging from heavy naphthas to heavy reduced crudes. An important development is the provision of a tubular heater for cycle gas to replace the "stoves" used in the original plant. The cycle gas heater, vaporizer and superheater coils are incorporated in a single furnace fired by gas. The coils are heated entirely by convection and each unit is controlled separately. In a commercial plant a conventional pipe still can be used. The charge, preheated by scrubber vapours, passes to the vaporizer, leaving normally at a temperature of 800–825° F. and entering the flash drum. The vapours then pass to the superheater coil, where the temperature is raised to 1000° F. and into the reaction chamber. Cycle gas at a temperature of 1150° F. may be by-passed at will to the flash drum, the vapour line to flash drum, the superheater or the line from superheater to reaction chamber. The temperature of vapours entering the reaction chamber is thus held at about 1020° F. The vapours pass on to the scrubber at 920° F., entering at a point near the bottom, and ascend counter-current to flash drum bottoms which are thus stripped. The vapours then pass via heat exchangers to the fractionator, from which gases and vapours pass overhead to a condenser and accumulator. Temperature at the top of the fractionator is controlled by reflux from the accumulator bottoms, and wet gas from the top of the accumulator passes to a compressor, after-cooler, and finally to the cycle gas heater. Fractionator bottoms constitute recycle stock and tar from the flash drum is removed from the bottom of the scrubber. Greta crude (A.P.I. grav. 35·3°, 17% over at 300° F.) was topped to remove 15·9% straight-run gasoline of 60 octane number motor method, and E.P. 280° F. The topped crude was then cracked and re-formed in the experimental unit. The final yield of gasoline obtained from the crude was 75% and the properties of this gasoline were: A.P.I. grav. 53·4°; E.P. 405° F.; octane number motor method 72·5. Residue having a viscosity S.F. at 122° F. of 122 secs., amounted to 11·6%, and gas and loss to 13·4%. Operating the unit on heavy residue from E. Texas and coastal crude having A.P.I. grav. 22·3°, 10% over at 495° F., 50% at 622° F., yields of 47·6% gasoline, 42·4% residue and 10% gas and loss were obtained. The properties of the gasoline were: A.P.I. grav. 47·1°; E.P. 427° F., Reid V.P. 10 lb. octane rating motor method, 77. The properties of the residue were: A.P.I. grav. 7·1°, pour point 0° F., visc. S.F. at 122° F. 43 secs., B.S. & W. content 0·6%.

As yet there has been no coking at any stage of the operation. R. A. E.

665.54

72. Patents on Cracking. W. M. Stratford. U.S.P. 2,020,086, 5.11.35. Cracked residue from a reactor is passed to a surge drum so arranged as to operate at reduced pressure and to cushion the effect of uneven delivery from the reactor. The surge drum is also arranged so that distillation will take place when the pressure therein exceeds a predetermined amount.

H. Dimmig. U.S.P. 2,020,241, 5.11.35. Solid deposits are removed from transfer lines by the reciprocating action of a hemispherically-shaped plunger head provided with passages.

B. W. Morgan. U.S.P. 2,020,653, 12.11.35. A cracking process in which the vaporization of the cracked products is controlled in order to prevent leaving an unnecessarily heavy residue or entrainment of heavy oil in the cracked vapours.

R. E. Wilson. U.S.P. 2,021,471, 19.11.35. Unvaporized oil from an expansion chamber is discharged into another chamber maintained under reduced pressure while cracked vapours from the expansion chamber are passed upwards through the residue in the reduced pressure chamber.

A. M. Wood. U.S.P. 2,021,761, 19.11.35. A process in which light cracked fractions are released as soon as formed and incondensable gas is injected at frequent intervals during the passage of the oil through the preheater. This procedure provides a more effective control of the cracking operation.

A. E. Pew. U.S.P. 2,021,923, 26.11.35. A process of reforming heavy naphtha which has a critical temperature below that of effective cracking. The naphtha is heated to just below the critical temperature in order to effect an increase in the latter, and the temperature then increased in step with the rise in critical temperature. The oil can thus be raised to an efficient cracking temperature, and yet be maintained below its increased critical temperature.

H. S. Reed. U.S.P. 2,022,054, 26.11.35. Cracking apparatus comprising a combination of an externally heated rotating horizontal retort and two-stage distilling and cracking chamber. Means are provided for continuously removing solid residue.

F. W. Sullivan. U.S.P. 2,022,221, 26.11.35. Oil is cracked in the presence of recycled unsaturated normally gaseous hydrocarbons formed in the process and from which substantial amounts of hydrogen and methane have been removed. The yield and octane number of the gasoline so produced are stated to be increased by this means.

W. L. Gomory. U.S.P. 2,022,280, 26.11.35. A process in which the vapour fraction evolved in a reflux stripping zone is conducted partly to the main vaporizing zone and partly to the fractionating zone. W. H. T.

Gas.

541.126

73. Prevention of Gas Explosions by Controlling Oxygen Concentration. G. W. Jones and R. E. Kennedy. *Ind. Eng. Chem.*, 1935, **27**, 1344.—An investigation of the values below which oxygen must be maintained to prevent explosions of combustible vapours or gases, is detailed. Previous workers have used a "residual atmosphere" method; *i.e.* the oxygen content of a mixture after the flame becomes extinguished, on burning a combustible in a closed space. The method gave results which varied with the design of burner, and therefore an "explosion tube" procedure was used in subsequent work. This employed an explosion chamber sufficiently large to eliminate the cooling effect of the walls of the chamber and to ascertain whether the flame continued to propagate independently of the heating effects of the source of ignition. The lower end of the explosion tube was closed with a ground-glass plate and the apparatus evacuated. Dry gas mixture was passed into the tube, the glass plate removed and a flame passed across the open end. With inflammable mixtures, the flame travelled to the top of the tube, but mixtures giving only a short travel were considered to be non-inflammable. Using carbon dioxide (*a*) and nitrogen (*b*) as inert diluents, the following critical values were obtained for oxygen concentration :—

CH_4 : 14·6% (*a*), 12·1% (*b*), C_2H_6 : 14·3% (*a*), 11·4% (*b*)
C_4H_{10} : 14·5% (*a*), 12·1% (*b*), C_5H_{12} : 14·4% (*a*), 12·1% (*b*)
C_6H_{14} : 14·5% (*a*), 11·9% (*b*), C_2H_4 : 11·7% (*a*), 10·0% (*b*)
C_3H_6 : 14·1% (*a*), 11·9% (*b*), H_2 : 5·9% (*a*), 5·0% (*b*)
CO : 5·9% (*a*), 5·6% (*b*)

Elevated temperatures were found to cause a widening of the inflammable limits of combustible gases and vapours, and therefore a decrease in oxygen concentration was necessary to prevent flame propagation. The values obtained hold only for temperatures below 40° C. and for normal variation in atmospheric pressure.

W. H. T.

665.58

74. Patents on Gas. A. Cambron and C. H. Bayley. E.P. 425,606, 11.3.35. Thermal treatment of hydrocarbon gases in which velocity of flow is repeatedly varied at successive unobstructed annular spaces adjacent to the heated wall of the reaction zone. This arrangement, it is claimed, permits greater control of the reaction and of the products.

V. Ipatieff. U.S.P. 2,020,649, 12.11.35. Conversion of normally gaseous olefines to motor fuel by treatment at elevated temperatures with a contact agent comprising phosphoric acid, aluminium oxide, zinc oxide and zinc chloride. W. H. T.

Motor Fuels.

665.58

75. Synthetic Gasoline from Carbon Monoxide and Hydrogen. I. S. Tsutsumi. *J. Fuel Soc. Japan*, 1935, **14** (157), 110–116.—The results given in Report No. 31 of the Imperial Fuel Research Institute indicate that the synthesis of gasoline from CO and H_2 may be summarized as follows.

(1) There exist an optimum reaction temperature and gas velocity for the formation of gasoline.

(2) From the standpoints of the life of the catalyst and the gasoline yield, it is preferable to use in the gas mixture an excess of hydrogen over the ratio $CO : H_2 = 1 : 2$.

(3) The best ratio nickel : kieselguhr for gasoline formation was 3 : 4 or 1 : 1.

(4) The catalyst prepared from the acetate showed the same activity as that from the nitrate.

(5) The nickel catalyst was studied; using a Ni + 20% Mn + 8% U_3O_8 + 4% ThO_2 catalyst, 168 c.c. of liquid hydrocarbons were obtained from 1 cu. metre of gas mixture.

(6) The effect of the addition of copper on the reduction temperature of cobalt oxide or mixed oxides of cobalt and nickel was studied. In a CO + 10% Cu + 12% U_3O_8 catalyst half the cobalt may be replaced by nickel without any effect on its activity.

(7) Silver was found to be superior to copper as a catalytic promoter. G. R. N.

662.753.1 : 665.58

76. Patents on Motor Fuels. Bat. Petm. Mij. E.P. 437,072, 23.10.35. Preparation of cyclic compounds containing side-chains in which unsaturated non-hydroxylated cyclic compounds are reacted at 150–300° C. and up to 50 atm. pressure with olefines in the presence of anhydrous phosphorus pentoxide. The latter is suspended in a liquid, and, if desired, in the presence of a peptizing or stabilizing agent.

A. L. Mond. E.P. 437,023, 21.10.35. Refining of cracked spirit by treatment with a solid active adsorbent at elevated temperatures and pressures suitable to maintain the spirit in the liquid phase. Relatively unstable low-boiling constituents are removed prior to treatment.

A. L. Mond. E.P. 437,188, 14.10.35. Gasoline hydrocarbons are produced from normally gaseous olefins having more than two carbon atoms, by polymerization using phosphoric acid as the catalyst at suitable temperatures. The phosphoric acid is mixed with a solid siliceous material previously calcined at 180–300° C.

T. T. Gray. U.S.P. 2,020,115, 5.11.35. Apparatus for the refining of cracked spirit by means of solid adsorbents, in which means are provided for progressively replacing the adsorbent as it becomes inactive.

W. A. Schulze and L. V. Chaney. U.S.P. 2,020,661, 12.11.35. A process for the removal of elementary sulphur from petroleum oils, in which the oil is contacted with an aqueous solution of an alkali or alkaline-earth polysulphide (lower than the tetrasulphide).

J. C. Morrell and G. Egloff. U.S.P. 2,021,739, 19.11.35. Vapour-phase refining, using an aqueous solution containing free hypochlorous acid in the presence of a zinc halide in the solid phase.

J. C. Morrell and G. Egloff. U.S.P. 2,021,740, 19.11.35. Vapour-phase desulphurization, using an aqueous solution containing a free oxygenated halogen acid selected from the following: hypochlorous, chloric, bromic or iodic acids.

F. M. Archibald and P. Janssen. U.S.P. 2,022,268, 26.11.35. A 2-stage process for purifying naphtha, recovered as a residue after the extraction of olefines by sulphuric acid in the manufacture of secondary butyl and amyl alcohol. In the first stage, the material is heated at 80–150° C. and 30–70 lb./sq. in. pressure, and in the second at 100–150° C. and 5–25 lb./sq. in. pressure in the presence of a 2–10% aqueous solution of caustic soda. W. H. T.

Lubricants.

621.892 : 621.436

77. Dilution of Diesel Engine Lubricating Oils. —. Louis and —. Larouche. *Ann. des Comb. Liq.*, 1935, **10**, 679–689.—If the engine is in good condition, dilution is small. A vacuum distillation method permits the separation of gas oil from lubricating oil. The authors described a cathodic vacuum distillation method in the *Proc. World Petr. Cong. London*, 1933, and the present paper describes work in mixtures containing known amounts of gas oil. It was found that the practical and theoretical curves are quite close. Too much importance must not be attached to the initial boiling point, as this depends on the rate of heating. Moreover, the boiling ranges of mixtures of the same gas oil with different lubricating oils are practically the same. The determination of refractive index can also be used to determine the amount of diluent J. L. T.

621.315.615.2

78. Report of the International Electrotechnical Commission. E. A. Evans. *J.I.P.T.*, 1935, **21**, 982–985.—A report of the I.E.C. held at The Hague, June 18–21, 1935, which shows that, with regard to the classification of transformer oils, modification of the test methods, particularly the sludging test, is desirable, and to attain this end further research will be necessary. G. R. N.

665.521.5

79. Patents on Lubricants. Burmah Oil Co. E.P. 437,053, 23.10.35. A wax sweating stove comprising a vessel fitted with a multiplicity of small-diameter pipes through which heating or cooling fluid flows. The pipes penetrate through a multiplicity of heat-conducting fins.

Akt. Separator Nobel. E.P. 437,483, 30.10.35. A method for the treatment of wax-containing oil which comprises chilling and treating the material with acid and separating oil from the residue of wax, acid sludge and acid. The residue is centrifuged at a temperature above that of the melting point of the wax, and the latter separated from the sludge and acid.

Stand. Oil Dev. Co. E.P. 436,998, 22.10.35. A grease comprising a hydrocarbon oil, a lime soap sufficient to emulsify the oil and an amorphous hydrocarbon wax in an amount sufficient to prevent sweating of oil, the whole being emulsified with a small quantity of water.

Brit. Thomson Houston Co. E.P. 437,174, 24.10.35. Mineral oils are purified by treatment with a mixture (5 lb./gal.) of 85 parts of sulphuric acid and 15 parts of phosphoric acid.

A. J. van Peski. U.S.P. 2,019,772, 5.11.35. Production of lubricating oils from cracked light distillate. Undesirable constituents are first removed by a light catalytic polymerization treatment and the purified material is further polymerized to form the desired product.

M. Kiser. U.S.P. 2,020,066, 5.11.35. Solvent dewaxing using a benzole-containing solvent. The mixture of oil, wax and solvent is chilled to 0–40° F., thereby precipitating the benzole in crystalline form in sufficient amount to provide a solid filter-aid material which facilitates the separation of wax from the mixture.

L. A. Clarke. U.S.P. 2,020,290, 12.11.35. Solvent refining by means of a low-boiling aliphatic acyl derivative of furan.

O. W. Pettit. U.S.P. 2,020,570, 12.11.35. Apparatus for reclaiming used lubricating oil, by means of which exhaust gases remove the diluent which is returned to the engine for consumption.

R. E. Manley and W. P. Gee. U.S.P. 2,020,693, 12.11.35. Dewaxing oil–wax mixtures by filtration in contact with a filter aid. Wax is separated from the filter aid and the latter heated at high temperature to remove adsorbed matter and to restore its properties.

J. M. Musselman. U.S.P. 2,020,954, 12.11.35. Lubricating oil fractions are refined by the simultaneous action of 5–10% of aluminium chloride and 5–10% of clay at 300–500° F. for ½ to 4 hours.

C. R. McKay and J. H. Smith. U.S.P. 2,022,358, 26.11.35. A process for refining and colour stabilizing mineral oils, in which the acid-treated oil is mixed with a metal hydrate in order to consolidate the sludge without fully neutralizing the mineral acidity. The clarified oil is then treated, hot, with solid adsorbent.

J. V. Starr. U.S.P. 2,022,259, 26.11.35. A counter-current solvent extraction process in which pure solvent is introduced at an intermediate point in the system in addition to that introduced at the refined oil exit.

M. H. Tuttle. U.S.P. Re 19,763, 19.11.35. Extraction of oil with cresylic acid in the presence of an added liquid (*e.g.* propane) having a greater solvent power for paraffinic constituents than for naphthenic constituents of the oil. The paraffinic solvent and the cresylic acid are adapted to form a two-phase solvent system.

W. H. T.

Asphalt and Bitumen.

625.85 : 6.0014

80. Instructions Concerning Floated Asphalt. *Bull. Perm. Int. Assoc. Road Cong.*, 1935, **24**, 246–253.—An account is given of the mechanical tests used in the Danish Laboratory for Road-building for examining the stability of floated asphalt. The methods of preparing and testing the specimens are, with the exception of the flexion and traction tests, those described in the German standards. The tests are made on specimens prepared from the material as tipped on to the road or, in some cases, cut from the surfacing after laying.

A. O.

625.85 : 620.178.153

81. An Impact Test for Studying Characteristics of Asphalt Paving Mixtures. R. Vokac. *Proc. Assoc. Asphalt Paving Tech.*, Jan. 1935, 40–48.—A description is given of the use of the Page Impact Machine (A.S.T.M. Serial Designation D. 3–18) to obtain information on the impact-resisting strength of a paving mixture, a measure of its degree of brittleness or toughness and of its tendency to deform in service.

The amount of impact energy applied to a briquette of the paving material is measured, and the data obtained are graphically analysed and interpreted in terms of the properties of the asphalt mixture. Briquettes of 1 in. depth and 2 in. diameter are prepared under a pressure of 5000 lb./sq. in., cured for 18 hours in air oven at 140° F. and recompacted. Six briquettes are used for each test in the impact machine, each being subjected to five blows per minute until complete failure from a 2-kg. hammer, falling from logarithmically increasing heights, viz. 4, 6, 10, 18, 34 and 66 cm. resp. The number of blows necessary to cause initial crack is taken as "impending failure" and that to break the specimen apart as "total failure." Plotting the number of blows (n) against the height from which the hammer falls (h) gives parallel straight-line relationships for impending and total failure data. This is expressed as a general equation $h = \frac{C}{n^d}$, where C and d are constants which can be determined graphically. Brittleness is taken as the conditions obtaining when a specimen is broken under a single impact and the energy W applied being derived from the previous equation ($W = C/50$ kg./metre). Toughness is assumed to be represented by the portion of the energy used to rupture the sample after the point of impending failure has been reached. If W_1 and W_2 are taken as the energy required to cause impending and total failure under 1 impact, the degree of brittleness is repre-

sented by $\frac{W1}{W2}$ and the degree of toughness as $\frac{W2 - W1}{W2}$. The index of deformation is found from the slope of the previous number of impact *vs.* height of fall curves, since soft, easily deformed materials show a greater slope than hard, more rigid samples, and is taken as the exponent d in the first equation. C. L. G.

625.85 : 620.178.16

82. Bituminous Mixes Under Moving Wheel Loads. H. F. Kriege and L. C. Gilbert, *Proc. Assoc. Asphalt Paving Tech.*, Jan. 1935, 28–39.—Data are presented on the results of laboratory tests by the moving-wheel load method on the strength of bituminous mixtures. From tests on a series of samples taken from hot-mix two-course asphaltic concrete (shown diagrammatically), it is shown that the structural strength increases with the percentage of fine aggregate (passing 10 mesh), more being required with the surface coat than with the binder course to give the same strength. A similar chart based on a wide range of pavement samples, including hot and cold mixes, cold mixes laid hot and varying aggregates—slag, limestone and trap rock, gives a straight-line relationship between percentage of fine aggregate and strength up to more than 30% of fines, after which it flattens abruptly. From the results of laboratory and practical data, the following formula has been developed to indicate the bitumen content for a mix containing any desired percentage of fine aggregate :—Bitumen Content % = 3·0 + (0·1% × fine aggregate percentage). The results of structural strength tests on sheet asphalt with varying bitumen contents indicated the optimum content as 11·0%, which agreed with practical tests and with the Hubbard field test.

Examination of sections from a test road was carried out by placing 2-ft.-square steel plates on the foundation, and after completion of the road the plates were located and removed with the pavement samples. Tests on these samples were duplicated on similar samples made up in the laboratory. The results are indicated diagrammatically, and references made to the surface behaviour. The highest strength was shown by one-course asphaltic concrete mixes with 60% fine aggregate. Substitution of slag by limestone did not affect the structural strength found. It is recommended that more attention should be paid to the design of road mixes based on mastic void relationships similar to the mortar–void relationship which has been worked out for Portland Cement concrete. C. L. G.

665.521.8 : 532.13

83. Evaluation of Bitumen by Absolute Viscosity. J. Csagoly. *Asphalt u. Teer*, 1935, **35**, 667–672, 687–690.—The various tests applied to bitumen are all essentially viscosity measurements. For instance, the ring-and-ball softening point measures the temperature at which the viscosity has fallen sufficiently for the bitumen to deform under a given load. The same softening point can be given by both good and bad substances, so that the test is no index of quality. A large number of tests are necessary to evaluate a bitumen, and even then the conclusions may not be accurate. Chemical analysis is tedious and inaccurate, whilst spectral analysis of the constituents separated by different solvents does not give very promising results. The author proposes the use of absolute viscosity as the best and shortest means of evaluating a bitumen, and adapts Marschalko's torsion viscometer, designed round Couette's apparatus and developed for lubricating oils, to determine this. This viscometer consists of two concentric cylinders with an annular space for about 50 ml. of substance under test. The outer cylinder is given a torque and the inner cylinder is prevented from rotating by applying a brake, actuated by a beam on which a weight is hung. The outer cylinder is driven by an electric motor, whilst its temperature is maintained constant by an electric heater, thermally regulated. Temperatures t_1, t_2 and t_3 are measured (or they can be calculated by a formula given) at which the corresponding absolute viscosities have values of 50, 1 and 0·5 poise. It is found that the value of $t_3 - t_1$ decreases linearly with increasing softening point, and is characteristic for each kind of bitumen. Imported bitumens of the Mexican type show a greater "temperature interval" than bitumens prepared in Hungarian refineries chiefly from Rumanian crudes, and are believed to be much superior to the latter bitumens. If $t_3 - t_1$ is plotted against t_1, a different straight line is obtained for each kind of bitumen. If the ring-and-ball softening points are marked on these straight lines

and joined up, a regular network of lines is obtained. The same system is obtained with penetration values, but not with ductility values, which it is considered cannot be determined with sufficient accuracy. It is also shown that bitumens with the same ring-and-ball softening points have different viscosity–temperature relationships, whilst increase of wax content gives a lower $t_2 - t_1$ value. Graphs are given which show "qualification zones," the boundary lines of which are determined by the ring-and-ball softening point. The nearer the point given by the $t_2 - t_1$ and t_1 values is to the ordinate, the softer is the bitumen. J. L. T.

665.521.8 : 625.848

84. Rept. of Committee on Asphaltic Joint Fillers. J. S. Crandell. *Proc. Assoc. Asphalt Paving Tech.*, Jan. 1935, 1–7.—A report is presented on a wide range of materials which have been tried out for filling joints in concrete and block pavements. 85–100 pen. asphalt filled with Celite or an approved diatomaceous earth showed good adhesion and resistance to flow, but required careful control during mixing, whilst sealing of the joints was not complete. The same grade without filler flowed during the summer, whilst a blown 30–80 pen. brick filler was too brittle in cold weather. Mixtures of asphalt with cork, sawdust, wood flour and flue dust were in some cases successful, but did not stick to the concrete, and tended to settle during mixing. Adhesion of fillers to concrete is greatly improved by thorough scrubbing of the joints with kerosine. Rubber–asphalt and sulphur–sand mixes have been found very satisfactory, but the latter is extremely difficult to apply successfully. In contrast to the above poured fillers, a slow curing cutback-sand cushion has been found successful in laboratory tests. In practice, however, if enough cutback is added to coat the sand completely, the mix is too fluid. An asphalt cement of the required viscosity would require heating for application, whilst a rapid curing cutback mix of the required bitumen content tends to push up between the bricks when rolling. Reference is made to a joint filler of fused crushed cork, which appears to be satisfactory where temperature conditions are not extreme. C. L. G.

665.521.8.004.14

85. Bitumen as an Adhesive for Fixing Linoleum. W. Bierhalter. *Asphalt u. Teer*, 1935, **35**, 865–867.—Bitumen has advantages over resinous materials for fixing linoleum, *e.g.* to cement floors. It is more resistant to moisture, and it is particularly useful in cellars and when the linoleum is to be laid on floated asphalt. For cement surfaces, care must be taken that the surface before treatment is quite dry and dust free. A preliminary treatment with bitumen in a suitable solvent may be given to seal the pores. C. C.

Special Products.

665.5 : 632.951.8

86. Tar and Petroleum Oils. Proposed Standards for Insecticidal Use. Anon. *Chem. Trade Journal*, 8.11.35, **97**, 393.—The Council of the Association of Advisory Entomologists has reprinted for sale copies of the draft specifications and methods of analysis for the tar-distillate and mineral oil washes and mixed oil washes published by Dr. Hubert Martin of Long Ashton Research Station in *The Annals of Applied Biology*, May 1935. The suggestions are based on published information available, and a full review is given of the evidence in their favour. The specifications are put forward as a basis to encourage further experiments with properly analysed and controlled samples.

Petroleum oils suitable for the preparation of spray fluids are covered by grades E, F and G, and should consist entirely of neutral oils, free from alkali, having a specific gravity between 0·86 and 0·92 at 60° F. Other requirements are :—

	Grade E.	Grade F.	Grade G.
Visc R.I. at 70° F.	125/500 secs	100/400 secs.	75/150 secs.
90% min. distilling above	315° C.	310° C.	300° C.
50% min. „ „	350° C.	345° C.	340° C.
20% min. „ „	380° C.	375° C.	370° C.
Min. unsulphonated residue	60% vol.	80% vol.	90% vol.

Grade G oils should also distil not less than 10% below 330° C. and not less than 80% below 390° C. The grades are suitable for the preparation of the following: E, winter washes or washes for application at certain periods intermediate between bud burst and bloom on varieties of fruit tolerant to petroleum oils less highly refined than grade F; F, washes for application at the latter period on varieties tolerant to oils less highly refined than Grade G oils; G, sprays applied to the foliage of oil-tolerant varieties of plant. The methods of analysis to be used are described. Specifications for tar oils Grades A and B are also given.

The successful use of oils of the above grades is dependent on proper application in spray form, for which suitable methods of emulsification are necessary. Specifications for miscible oils and stock emulsions, which merely require mixing with water to give the desired spray, are given, together with a description of the application of the sprays. R. A. E.

665.545

87. Naphthenic Acids. Y. Mayor. *Chem. Ind.*, 1935, **34**, 926.—Caucasian, Persian and Rumanian oils contain saturated cyclic hydrocarbons (*e.g.* naphthenes). The oxygen content of fresh crude oil does not exceed 3%, but after exposure to air this amount increases, and is combined in phenolic and acidic material, the latter occurring as naphthenic acids. These are brown viscous oils (sp. gr. 0·97–0·99) which distil with partial decomposition between 200° and 300° C. Normally, the crude acid is distilled with steam or under vacuum, refining consisting of treatment with sulphuric acid followed by neutralization, after which the acids are recovered. More recent methods of recovery are: (1) to treat with excess of alkali at 120–150° C., to dissolve the salt in water, to acidify and finally to blend the naphthenic acids with a light oil fraction and to recover the desired product by fractional distillation; (2) to distil the naphthenic acid in the presence of calcium or sodium oxide. The naphthenic salts are separated from hydrocarbons by solution in alcohol and then purified by aeration in the presence of cobalt naphthenate in benzene solution. Another method of purification is to convert the acid into the corresponding amino-compound, which may be decomposed by reduction with sodium and alcohol. By the action of a benzene or chloroform solution of ammonia on a naphthenic acid–sulphuric acid mixture, the amino-compound is produced with a yield of 70–90%. The free acid is used in the preparation of bactericides and insecticides and in the rubber industry. The salts are used in cheap soaps, as an addition to cement because of its drying action (Ca, Al, Co, V, Zr, salts) and in the preservation of wood, paper, etc. ($Cu–NH_4$ salt). Because of its moistening action, the naphthenic ether is used in the dyeing industry, and after sulphonation the naphthenic acids form dye-stuff intermediates. P. C. K.

Engines.

621.432

88. Undue Cylinder Wear in Internal Combustion and Steam Engines. H. J. Young. *J.I.A.E.*, 1935, **4** (2), 26–43.—The fact that the location of undue cylinder wear is the same for all engines, viz. opposite the first free ring at the top dead centre, whether the engine runs on steam, gas or oil, suggests that there must be a condition common to all engines to account for this unexceptional phenomenon.

The paper deals with wear of sand-cast grey irons mainly from a metallurgical point of view. It is contended that such terms as "close-grained" and a specified hardness mean nothing as regards wearing qualities. Contrary to previous practice, the author states that sulphur is the element more than all others which increases the resistance to wear. A research aiming at the production of a high sulphur iron, with avoidance of the difficulties associated with such material, would be worth while, and appears to be within the reach of those foundries working the Perlit process. The structure of cast-iron is the all-important factor, and many photomicrographs are reproduced to illustrate how the iron holds the important constituents such as graphite, phosphide lakes and sulphide globules in position, and how, when oil polished, the surface is capable of retaining the oil film. Tables are given showing the cylinder wear on vehicles of a large bus company with liners of unknown make and with improved all-pearlitic sand-cast grey iron.

It is well known that excessive wear is caused when an engine is run cold due to lack of lubrication, and the author contends that under these conditions it is unscientific to attribute such wear mainly to the effects of corrosion. C. H. S.

621.43.03

89. Deposits in White Metal Carburettors. E. L. Baldeschwieler, G. M. Maverick and J. E. Neudeck. *J.S.A.E.*, 1935, **37** (4), 17–21.—From time to time complaints have been received of the stoppage of fuel flow by powdery material deposited in white-metal die-cast carburettors. Although precipitation from leaded fuels has often been blamed for this, it has been shown that similar deposits occur when unleaded fuels are used. Analysis has shown that the deposit consists mainly of zinc oxide and zinc hydroxide derived from the corrosion of the metal of the carburettor. A series of experiments are described in which strips of carburettor metal were subjected to the action of gasoline, water, and mixtures of the two at room temperature. These experiments confirmed the fact that the corrosion is due to the action of water on the metal, the reaction being accelerated by the presence of oxygen and salts, *e.g.* by sea-water. An analysis of the dried precipitate formed showed that it contained 84% zinc oxide and 16% water. Similar corrosion occurs with any galvanized surface, and in the latter case there is the added danger of electrolysis at the zinc/iron surface. C. C.

621.434 : 662.766.4

90. Characteristics of Internal Combustion Engine Using Butane–Air Mixtures. C. J. Vogt. *Oil & Gas J.*, 14.11.35, **34** (26), 52; *Refiner*, 1935, **14**, 542.—An engine-test programme to investigate the influence of the many variables of design, operation and change of fuel on engine economy and output was commenced in the University of California in 1932. A single-cylinder engine of $3\frac{1}{16}$-in. bore and $4\frac{1}{2}$-in. stroke was used in the tests. The compression ratio can be varied between 3·5 and 8·7/1, the exhaust and intake cams can be set independently, means for ascertaining spark timing are provided, the cooling system is a self-contained unit using distilled water, and load can be measured within 0·01 lb. The weight of air admitted to the engine is measured by a special device, fuel consumption is also measured and a line for the liquid fuels is led from the needle valve of a $1\frac{1}{4}$-in. Schebler carburettor to the venturi of the carburettor for gaseous fuels, thus permitting use of one induction system for all fuels. Other refinements and the method of operation are described. Relationships investigated include: friction loss as a function of compression ratio; the effect on volumetric efficiency of engine speed, compression ratio, mixture ratio, and spark advance as separate factors; compression pressures as a function of compression ratio and of engine speed at a fixed compression ratio; effect of engine speed on output. For butane–air mixtures the effects on economy and power of variations in mixture and throttle position, and also variations in spark advance and throttle position were determined. Graphs are presented to illustrate the results obtained as a result of these investigations, and theories are advanced in explanation of some of the relationships ascertained.

When using butane it is possible to increase the compression ratio of the engine appreciably over that allowable when operating with gasoline. The economy was higher with gasoline than with butane at the same compression ratio. This is contrary to road experience, and it is evident that the better distribution of the butane–air mixture in multi-cylinder engines is the explanation of this apparent contradiction in results. The output of the engines was found to be higher with butane as fuel for the same conditions of operation. This was due to the type of carburettor first used for the different fuels, the venturi required for gasolines being smaller at the throat than the venturi required for gaseous fuels. Later tests in which the common induction system was used did not show appreciable variation for similar operating conditions.

Tests indicated that, within certain limits, variation in spark intensity did not increase or decrease power developed after the engine was warmed. R. A. E.

Detonation.

621.43.019.4

91. Induction Period in Gaseous Thermal Explosions. O. K. Rice, A. O. Allen and H. C. Campbell. *J.A.C.S.*, 1935, **57**, 2212–2222.—Integration of the differential equation connecting temperature with time in an exothermic gas reaction suggests that above a certain sharply defined pressure a sudden temperature rise, corresponding to an explosion, will occur. An approximate method for calculating the induction period in thermal explosions has been obtained from curves of the above type.
W. E. J. B.

621.43.019.3

92. A Contribution to the Study of "Pinking." J. K. Thompson and R. V. Wheeler. *J.I.P.T.*, 1935, **21**, 931–939.—An account of experiments on the explosion of motor fuels in closed cylinders admixed with air or other gases and of the significance of the results with respect to the detonation characteristics of the fuels. G. R. N.

General.

553.98 : 553(52)

93. Petroleum Industry of Japan and Manchukuo. Anon. *Petr. Times*, 1935, **34**, 481.—A brief survey of the industry in 1934 is presented, and the prospects of the hydrogenation industry discussed. H. G.

665.5 : 0014

94. International Nomenclature for Petroleum and Mineral Oil Products. R. Schwarz. *Petr. Zeit.*, 13.11.35, **31** (45), 5–7.—A very useful list is given of nomenclature for different mineral oil products in 21 countries. This has been compiled by a well-known authority on the subject. In addition a table is given for the conversion of specific gravity into kgms./barrel, kgms./American gallon and kgms./(English) Imperial gallon. W. S. E. C.

REVIEWS AND BOOKS RECEIVED.

Review.

621.436–185.4

HIGH-SPEED DIESEL ENGINES. Arthur W. Judge. 347 pages, 284 illustrations. 1935. Chapman and Hall, Ltd., London. 15*s*.

THE first edition of this book was published in 1933, and has now been enlarged and revised in the light of recent developments to form the present second edition. It deals very comprehensively with the whole subject in a way calculated to be of the most use to the student from a theoretical and practical point of view. The author has purposely omitted such subjects as the mathematics of thermodynamics, as standard works can be resorted to for such studies.

After a brief historical review of the development of the diesel engine in the first chapter, Chapters II and III are devoted to the theory of, and actual conditions obtaining in, C.I. engines. This section of the book explains in a very clear manner the constant-pressure and constant-volume cycles, and gives formulæ and tables for the estimation of efficiencies, compression temperature, and M.E.P.'s, both from the theoretical point of view and in the light of modern practice.

Before describing in detail practically all the well-known combustion heads, the author devotes two chapters to an analysis of the relative merits of the high-speed C.I. engine and the gasoline engine, and the different general types of fuel injection and combustion methods, including the latest conception of the phases of combustion and the factors having effect on the all-important ignition lag or delay angle. The general effects of other controllable variables are also discussed.

A large section of the book, consisting of some 80 pages, not only describes in detail the general types of fuel injection systems and the effect of practically every known variable in such systems, but also gives in great detail particulars of design of no less than seventeen makes of fuel pump, whilst fuel valves and nozzles are equally fully dealt with and excellent drawings are furnished of practically every one described.

Another chapter deals with the problems of the two-stroke engine, especially with those relating to efficient charging and scavenging and the control of air flow. Here again many makes of two-stroke engines are fully described.

Details of complete engines are grouped under three headings, namely, Automobile, Aircraft, and Stationary and Railway Types. Descriptions of almost every well-known engine are given, and these sections account for approximately a third of the whole volume.

Finally, the author devotes separate chapters to the care and maintenance of high-speed C.I. engines, fuel filters, and fuels and specifications of same, whilst the subject of cetene values, dopes and wear problems are briefly dealt with.

The chapter on fuels and specifications might have been elaborated somewhat, as no mention is made of laboratory tests such as "Diesel Index," which are proving to be of considerable assistance in the appraisal of straight diesel fuel in the laboratory. Some reference also to the work of Pope and others on "critical compression ratios" might have been included, as the "Cetene Value" has not yet become a universal standard, and research is at present being conducted in many laboratories to establish a standard test method on the lines of the A.S.T.M. Octane Number test for petrols.

The present edition of this book can be confidently recommended to anyone interested in diesel engines. It is exceptionally well illustrated, and valuable information can be obtained on many problems of design and operation. C. H. SPRAKE.

Books Received.

Department of Scientific and Industrial Research:

662.62(.061)

REPORT OF THE FUEL RESEARCH BOARD FOR THE YEAR ENDED 31ST MARCH, 1935. Pp. xi + 188. 1935, H.M. Stationery Office, London. 3*s*. 6*d*.

It is sometimes suggested that the fall in coal consumption is due to the replacement of coal by oil, but the report shows that this is largely erroneous and the decrease is due mainly to the increased efficiency in processes for which coal is used.

Researches have continued into the principles of hydrogenation of coal and the hydrogenation-cracking of tars and tar oils. These processes are being studied in technical-scale plants in order to obtain sufficient of the motor spirit and lubricating

oils for service test purposes. Diagrams and a description are given of a plant to treat about 300 gallons of tar per day. It has been found that hydrogenation does not necessarily require high pressures and a process has been worked out on a semi-commercial scale for treating tar acids at atmospheric pressure to obtain motor spirits.

Iron and Steel Institute :

621.791 : 669.1

SYMPOSIUM ON THE WELDING OF IRON AND STEEL. 2 vols. Pp. xx + 676 and vii + 974. 1935, The Iron and Steel Institute, London. £2 2*s*. 0*d*. Postage 1*s*. extra, 2*s*. abroad.

These two volumes contain the Proceedings of the Symposium on the Welding of Iron and Steel which was held on May 2nd and 3rd, 1935. The papers, which number 150, are by recognized authorities and cover all aspects of welding practice and theory. The papers are grouped as follows : (1) Present Day Practice and Problems of Welding in the Engineering Industries; (2) Welding Practice and Technique, including Welding Apparatus; (3) The Metallurgy of Welding; (4) Specification, Inspection, Testing, and Safety Aspects of Welding.

662.62

SPIERS, E. M. TECHNICAL DATA ON FUEL. Pp. xvi + 358, 256 tables, 66 diagrams. 4th edn. 1935, London, World Power Conference. 12*s*. 6*d*. net.

The fourth edition of this reference work has been extensively revised and much new matter added. Included in the new material are a number of items of interest to petroleum technologists, such as critical properties of gases and liquids, heats of combustion and formation of the normal paraffins and of alcohols, properties of alcohols compared with benzole and gasoline, rating of diesel fuels. The sections on fluid flow in pipes, on viscosity conversion, and on detonation have been completely revised and extended and the data on atomic weights and on specific heat of gases have been revised.

U.S. Bureau of Mines :

531.787

REPORT OF INVESTIGATIONS 3291. BUREAU OF MINES MULTIPLE-DIAPHRAGM RECORDING SUB-SURFACE-PRESSURE GAUGE. W. B. Berwald, H. A. Buss and C. E. Reistle, Jr. 19 pp. November 1935.

This report briefly describes the part played by the Bureau of Mines in the development of instruments for the measurement of sub-surface pressures in producing oil and gas wells. A new recording sub-surface-pressure gauge is described and details given of its design, construction and operation.

U.S. Geological Survey :

55(790)

BULL. 854. GEOLOGY AND ORE DEPOSITS OF THE CASTO QUADRANGLE, IDAHO. C. P. Ross. Pp. vi + 135. 1935, Superintendent of Documents, Washington, D.C. 60 cents.

55(789)

BULL. 859. GEOLOGY OF THE SANTA RITA MINING AREA, NEW MEXICO. A. C. Spencer and S. Paige. Pp. iv + 78. 1935, Superintendent of Documents, Washington, D.C. 40 cents.

55(798)

BULL. 862. THE SOUTHERN ALASKA RANGE. S. R. Capps. Pp. iv + 101. 1935, Superintendent of Documents, Washington, D.C. 70 cents.

55(749)

PROF. PAPER 180. THE MINERALS OF FRANKLIN AND STERLING HILL, SUSSEX COUNTY, NEW JERSEY. C. Palache. Pp. vi + 135. 1935, Superintendent of Documents, Washington, D.C. 30 cents.

55(77)

PROF. PAPER 184. PRE-CAMBRIAN ROCKS OF THE LAKE SUPERIOR REGION. C. K. Leith, R. J. Lund and A. Leith. Pp. ii + 34. 1935, Superintendent of Documents, Washington, D.C. 60 cents.

ABSTRACTS.

	PAGE		PAGE
Geology	34 A	Polymerization	51 A
Geophysics	39 A	Gas	52 A
Drilling	39 A	Motor Fuels	54 A
Production	40 A	Lubricants	55 A
Pipe-Lines	41 A	Fuel Oil	58 A
Transport	42 A	Asphalt and Bitumen	58 A
Crude Petroleum	43 A	Special Products	60 A
Chemistry of Petroleum	44 A	Engines	60 A
Analysis and Testing	46 A	Detonation	61 A
Cracking	49 A	General	62 A
Hydrogenation	50 A	Reviews and Books Received ...	65 A

AUTHOR INDEX.

The numbers refer to the Abstract Number.

Albright, J. C., 118
Anderson, R. O., 114
Anglo-Iranian Oil Co., Ltd., 168
Armstrong, G. J., 114
Assheton, E., 175

Babson, E. C., 113
Bahr, T., 128
Balada, A., 144
Barr, G., 136
Batasfsche Petroleum Mij., 159
Batcher, R. R., 182, 183
Beale, E. S. L., 181
Bilbao, E. S., 188
Bissenberg, H., 172
Brooks, B. T., 156
Broom, W. E. J., 140
Burford, S. O., 102
Burger, P., 178
Butt, P., 139

Chopra, R. P., 187
Carroust, R., 168
Cawley, C. M., 159
Celis, J. A., 121
Church, W. L., 114
Connolly, J. A., 114
Cooke, M. B., 153
Coutts & Co., 168
Cox, E. R., 129
Cunningham, W. A., 100
Currier, N. B., 117

Deutsche Röhrenwerke, 176
Dodds, R. M., 157
Dreyer, W. C., 111
Dreyfus, H., 186

Ebert, G., 156
Egloff, G., 152, 154
Enge, W., 156
Erdheim, E., 137
Evans, E. B., 157
Ewing, S., 120

Feller, P., 156
Fenske, M. R., 139
Fischer, F., 128
Fisher, E. K., 139
Flemming, E. L., 114
Fossa-Mancini, E., 108
Foster, A. L., 155
Franchetti, P., 163
Fürst, R., 110

Galliher, E. W., 95
Ganitachi, I., 124, 186
Garner, F. H., 140, 157
Garretz, J. B., 99
Gierhart, G. B., 98
Giffen, E., 180
Gordon, K., 150
Graefe, E., 165
Grosse, A. V., 156
Gruse, H. M., 114

Haalck, H., 109
Hackford, J. E., 159
Haeuber, H., 156
Halbouty, M. T., 105
Herbert, W., 156
Herbsman, A. M., 117
Herrick, H. N., 117
Hewgley, J. M., 117
Hill, F. F., 114
Hirsch, R. E., 139
Holland, C. J., 174
Horsley, G. F., 156
Haich, C. Y., 103
Hughes, J. D., 112
Hunt, T. N., 114

I.G. Farbenindustrie A.-G., 151, 159
Illeman, R., 176
International Hydrogenation Patents Co., 151
Ipatieff, V., 156
Iranth, F., 161
Isham, R. M., 156

James, A. S., 125
Johnson, J. Y., 168
Jones, P. H., 113

Kadmer, E. H., 145
Kane, W. G., 98
King, J. G., 159
Koch, H., 133
Kölbel, H., 133
Kraft, W. W., 166
Krassilchik, A., 127
Krupp, Fr., A.-G., 151
Kung, J., 115

Lacey, W. N., 120
Larson, A. T., 156
Layne, L. A., 114
Lenker, S., 156
Love, F. H., 118

McCollum, M., 114
McCullough, O. J., 114
McHatton, L. P., 148
Machin, App. Fabrik, 168
Machinerién en Apparaten Fabriker Mesf, N.V., 156
Mack, C., 170
Mackowski, L. L., 114
Mallison, A., 134
Merritt, J. W., 106
Meusel, A., 128
Moore, H., 142
Moore, R. C., 96
Moravec, R., 156
Mornhineg, A. R., 99
Murphy, G. B., 146

Nelson, E. F., 146
Neymann, E., 161

O'Donnell, L., 101

Pearce, S. J., 143
Pérébaskine, M. V., 97
Pichler, H., 132, 133
Pigate, R. J. S., 117
Planktokoll Chem. Fabrik, 168
Platz, H., 185
Post, E. S., 107
Pysal, E., 156

Renouil, Y., 164
Richardson, J. O., 147
Robbe, R., 162
Roberts, A. A., 169

Sage, B. H., 130
Schlumberger, C., 114
Schneegans, M. D., 97
Schrenk, H. H., 143
Serada, J., 131
Setkowicz, W., 141
Sinclair Refining Co., 168
Smith, H. M., 156
Smoley, E. R., 166
Spalding, J. D., 117
Spang, F. J., 114
Standard Oil Development Co., 168
Stansfield, R., 181
Sterrett, E., 179
Stratford, C. W., 159
Stuart, A. T., 156
Suida, H., 163
Swanson, H. B., 153

Taylor, F. W., 117
Temme, T., 173
Texas Development Corpn., 168
Tits, I. N., 159
Trimble, H. M., 147
Turova-Polyak, M. B., 135.

Universal Oil Products Co., 151

Wagner, C. R., 153
Watson, K., 146
Weiss, H., 138
Wilson, D. M., 171
Winkler, F., 156
Wood, N. E., 177

Yant, W. P., 143

Zeek, O. B., 114
Zelinskii, N. D., 135, 189
Zwerger, R. von, 116

Geology.

549.623.7

95. Geology of Glauconite. E. W. Galliher. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1569–1601.—Evidence is given to show that glauconite is simply a product of the alteration of biotite. In Monterey Bay, California, the grain-size of the sand decreases rapidly from the shore. Fine and very fine sand is found at depths of 5–40 fathoms, silt and clay predominating below that depth. This silt and clay is sufficiently compacted to eliminate aëration from the water. The sediments are mainly derived from rocks of a granitic type with associated schists and gneisses, and they were sampled by dredging all over the bay over a period of years. Examination of all these samples shows that there is a progressive change from biotite to glauconite as the sediments are traced from shallow to deeper water. The chemical change involved in this alteration is discussed, and it is suggested the anaërobic condition of the mud and the alkalinity of the water are decisive factors. Furthermore, slow deposition is necessary, for otherwise the biotite would be too quickly buried for it to be affected by the overlying water. These results may therefore be summarized as follows. Glauconite is rarely found in deep-sea deposits, since micaceous minerals mostly come to rest before reaching such depths. It is found in the vicinity of granitic and metamorphic rocks where deposition is slow. S. E. C.

551.24 : 551.73

96. Late Palæozoic Crustal Movements of Europe and North America. R. C. Moore. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1253–1307.—The upper Palæozoic earth movements in North America are compared with those in Europe. The European movements are first described somewhat briefly, and then the evidence of the North American movements is dealt with in more detail. Finally the evidence from both continents is compared and a correlation between the movements attempted. It is suggested that there are at least nine distinct periods of movement recognizable in North America in the post-Devonian part of the upper Palæozoic. The widespread break at the base of the Kinderhook is probably the time equivalent of the Selkian phase of the Bretonian movements, whilst the break at the base of the Chester series corresponds to the Sudetian orogeny. There is some evidence which seems to relate the commencement of the Pennsylvanian with the Erzegebirgian orogeny, but at present it is difficult to find any feature in Europe which corresponds with the Wichita orogeny. Epeirogenic movements that preceded Missouri time in North America are tentatively correlated with the Asturian orogeny. The Arbuckle orogeny is not apparent in the European record, nor are there any significant European movements to correspond with the Marathon orogeny. With regard to the Appalachian orogeny there is some doubt as to whether it is the equivalent of the Saalian orogeny or later. In general, it appears that times of orogenic movement in one continent are matched by epeirogenic movements in the other. S. E. C.

551.763/781.4 : 55(828)

97. Use of Foraminifera as Markers in Patagonia. M. V. Pérébaskine and M. D. Schneegans. *Ann. des Comb. Liq.*, 1935, **10** (6), 1093–1095.—In southern Patagonia the Cretaceous and Eocene sediments are generally of a marine facies of a seemingly uniform and unbroken character. Foraminiferal marls from a well at Rio Tres Puentes, which found oil in June 1932, have been examined, and certain forms have been found to characterize definite horizons. Some, such as Cristellaria, may range over 200 m. vertically, whilst others such as Cibicides may be limited to about 50 m. At certain horizons some forms, *e.g.* textularians or nodosarians, may become very abundant, though other less prolific types, such as Elphidium or Uvigerina, may serve as markers. The co-existence of a series of forms is also a valuable index. These foraminifera are useful for correlation purposes in thick, lithologically monotonous series, over a limited area. A list of the foraminifera as found in vertical sequence is given. G. D. H.

551.781.4 : 55(72)

98. Areal Geology of Eocene in North-eastern Mexico. W. G. Kane and G. B. Gierhart. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1357–1388.—The area covered in this paper

lies on the Mexican side of the Rio Grande and extends from Guerro, Coahuila, on the north, to the Rio San Juan and the Matamoras to Monterey railway on the south. The nomenclature is the same as that adopted by Deussen (U.S. Geol. Survey Bull. 837) except that the Carrizo sandstone is here included in the Claiborne instead of the Wilcox.

The Cretaceous–Eocene boundary is traced south-west and south from the Rio Grande until it crosses the state line into Nuevo Leon. It then bears south-east along the north-east flank of the Salado arch, swinging around the south-east plunging axis, and finally crosses the Rio Sabinas near Piedras Pintas, and is then covered by gravels, it being only occasionally visible down to the Rio Pesqueria. The basal Eocene beds are underlain by successively older Cretaceous beds as the contact is traced southwards, whilst the massive quartzitic sandstone which begins to appear near the contact below the Tortillas area is absent in the north.

The Midway formation outcrops in a narrow belt throughout the entire length of the area. It increases rapidly in thickness towards the south, it being only 200 ft. thick at the Rio Grande, whereas it is 650 ft. thick in a section west of San Ignacio. The Indio formation (Wilcox) at the Rio Grande is unconformable between the Midway and the Carrizo. There is no evidence of this unconformity continuing southwards, but a thickening of the section is seen. The Carrizo sandstone is here considered to be the basal member of the Claiborne group. It outcrops in a belt 1–4 miles wide throughout the area, and is overlain conformably by the Mount Selman formation. A gas-bearing horizon occurs 265 ft. below the top of the Mount Selman. The Cook Mountain formation lies conformably on the Mount Selman, and it is followed by the Yegua, the top member of the Claiborne group. The Fayette formation is the representative of the Jackson group.

This description of the stratigraphy is followed by a record of a number of measured sections. S. E. C.

551.781.5

99. Study of Vicksburg Group at Vicksburg, Mississippi. A. R. Mornhineg and J. B. Garrett. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1645–1667.—Previous literature on the subject is summarized. The object of the present paper is to define the Vicksburg group and describe the typical fauna. Cooke's classification of the group into the Byram marl, Marianna limestone, and Forest Hill sand is upheld, and the exact boundaries of these formations are given. A full list is also given of the foraminifera obtained by collecting at the type sections. S. E. C.

552.543 : 55(764)

100. Dolomite in Permian Limestones of West Texas. W. A. Cunningham. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1678–1692.—Determinations of calcium and magnesium contents were made on 150 samples from 35 wells. It was assumed, in the absence of evidence to the contrary, that the calcium and the magnesium were in the form of carbonates, and that the magnesium carbonate was in the form of dolomite. On the basis of these assumptions it was found that most of the limestone is highly dolomitic, exceptions being three wells in Reagan county and one well in Irion county, where no magnesium was found lower than 150 feet in the Blaine limestone. No uniformity in magnesium content was noticed in the porous sections. In one well the limestone belonged to the Clearfork instead of the Blaine, and this showed a higher magnesium content than was general in the Blaine. Microscopic distinction between pure limestone and the highly dolomitic variety proved to be very uncertain.

The origin of the dolomite is discussed from the chemical viewpoint, and three suggestions are made. It might have been formed by direct precipitation from solution. Another suggestion is that calcium carbonate was initially deposited and then partly replaced by magnesium carbonate. And, finally, the magnesium and calcium might have been deposited as hydroxides and subsequently converted into carbonates and dolomite.

The causes of troubles associated with acid treatment in these wells are also discussed. It was found that acid weaker than 10% HCl had little effect on cuttings without being heated, and that acid stronger than 15% was required to effect complete

disintegration. Oil-soaked cuttings resisted wetting by the acid, and also many cuttings contained a considerable proportion of fine, insoluble matter which would probably tend to choke the wells after acid treatment. S. E. C.

553.631 : 553(763)

101. Jefferson Island Salt Dome, Louisiana. L. O'Donnell. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1602–1644.—Salt was first found in 1894 when drilling a water well. In 1922 a shaft was sunk after drilling thirty-six exploratory wells, and mining of the salt commenced. Drilling for oil was commenced in 1924, but commercial production has not been obtained, although it is still considered a good prospect for flank oil. Sulphur was discovered when drilling a flank test well located after geophysical surveys had been carried out. It is being mined by the Frasch method.

The greater part of the salt dome lies beneath Lake Peigneur. A spine of salt, conical in shape, rises 850 ft. above the main salt mass, pierces and elevates the strata, and forms the surface mound which is Jefferson Island. Lake Peigneur was caused by subsidence after solution of the flat salt top. Solution of the salt spine will eventually lead to Jefferson Island being entirely surrounded by the lake. It is suggested that the salt spine was formed by salt being squeezed up through a crack in the hard cap-rock. After the formation of the spine a large mass of the cap-rock broke and was carried upwards with the spine, thus forming the salt stock. The salt is remarkably pure, and this explains the absence of a proper cap to the spine. The original cap-rock is considered to be sedimentary in origin. S. E. C.

553.631 : 553(764)

102. Structural Features of Brenham Salt Dome, Texas. S. O. Burford. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1330–1338.—The Brenham dome is situated approximately 75 miles north-west of Houston, and there are no surface indications of its presence. It was discovered in 1915, when heavy, black oil was found in a shallow water well. Practically all the production is from these shallow 100–200 ft. sands, there being from twenty-five to forty-five wells each producing an average of 1–5 brls. per day. The only deeper producing well was one which found production just above the cap-rock at 1000 ft. and produced 2–5 brls. per day for about 2 years.

Well data are scanty and unsatisfactory. The most evidence obtained concerns the south and east sides of the dome. It appears that the dome may lean slightly to the east, whilst there is a pronounced nose extending eastwards from its edge. The greatest movement took place subsequent to the Crockett (Eocene) and before the end of the Jackson (Eocene), the greatest uplift being on the east or south-east side. From the relative positions of the Crockett it appears that the salt mass rose a distance of 2950 ft. since the end of Crockett time. Some faulting took place at the north edge of the dome during this period of uplift. S. E. C.

553.982 : 553(31)

103. China's Future. C. Y. Hsieh. *Oil Weekly*, 30.12.35, **80** (3), 20–30.—Commercial development of the Yenchang seepage was attempted in 1901, and this, the first oil-field, is still one of the best prospects. The present production of China is only a few thousand brls./year.

A study of oil seepages, asphalt deposits, oil-shales and other data points to four main petroliferous basins: Tihua, Tarim, North Shensi, and Szechuan. There are also other likely areas.

Seepages occur in a number of districts in the Tihua basin. There are none in the Tarim basin, but the presence of extensive marine Cretaceous and Eocene strata is taken as a favourable sign. The North Shensi basin has abundant widely distributed seeps. The regional structure is a broad monocline, block faulted in places, and dipping gently west or north-west. At Yenchang, the most easterly field, oil was struck at depths of 210, 230 and 520 ft. At Ichun, Chungpu and Fushih, west of Yenchang, wells drilled to 3900, 3545 and 3000 ft. respectively found only traces of oil.

The Szechuan basin has many seepages. The Tseliutsing salt and gas area has given only negligible amounts of oil, and shows no good prospects, but to the north-

west and south-west of Tseliutsing there are favourable, undrilled structures. At Fuchungkou are twenty gas wells giving a very small amount of oil from an almost horizontal light green Cretaceous sandstone (lower part of Kiating formation). 50 km. south of Chungking is a seepage from a red Cretaceous sandstone on the western limb of a gentle anticline. Two test wells gave a small production of heavy black oil for many years.

Seepages occur from Cretaceous red beds in Western Kansu, and oil has been found in a thinly bedded Triassic limestone at Poumuchung, Kweichow province.

In the Szechuan and Shensi areas, petroliferous formations range Trias to Cretaceous. The original source seems to be the Trias which is marine in Szechuan, and so more promising than the continental Trias of Shensi. Three oil horizons occur in the Triassic and Jurassic of the North Shensi basin, whereas in Sinkiang the oil horizons are mainly Cretaceous or early Tertiary.

Szechuan and North Shensi are basins of considerable extent with great thicknesses of Mesozoic strata, and lie north and south of the great Tsingling mountain chain. The oil series in Szechuan is folded into a series of domes and anticlines. In North Shensi movement was less.

The two petroliferous areas in Sinkiang are great basins. The strata are generally almost horizontal, but have distinct folds and block faults.

Recent exploratory work in the North Shensi area has been confined to the eastern fields, Yenchang and Yenchun. Test wells have given favourable results.

Immense oil-shale deposits have been discovered in Shensi, Szechuan, Kuantung, Kuangsi, Hunan, Liaoning and Shansi. The Japanese are working the Fushun deposit in Liaoning, but the others are undeveloped. These shales are of Permian, Jurassic and Tertiary age and have an estimated oil yield of 400,000,000 tons.

G. D. H.

553.982 : 553(494)

104. Oil in Switzerland? Anon. *Petr. Times*, 1935, **34**, 528.—Drilling is to be undertaken in the neighbourhood of Saint Croix and Saint Aubin with equipment suitable for depths of 6000 ft.

Traces of oil have been found where the sub-Alpine molasse is concerned, in the Pontersalp on the Säntis, and in the Ricken tunnel. Heim considers it not impossible that deep drilling in the northern anticlinal zones of the sub-Alpine molasse might yield large quantities of gas, and possibly some oil. The Tuggen well was drilled in this district, but found only gas and traces of petroleum pitch. However, it was not preceded by thorough geological and geophysical work, and cannot be considered an adequate test of the sub-Alpine molasse.

Another likely area is that of the molasse plications bordering the Jura, traces of oil having been found between Geneva and Aarau. Small, but badly placed wells gave no definite data. It seems desirable that work should be centred on these regions, as the molasse plications of the sub-Jura are relatively simple tectonically.

G. D. H.

553.982 : 553(763) 550.834 : 55(763)

105. Geology and Geophysics of S.E. Flank of Jennings Dome, Louisiana, with Special Reference to Overhang. M. T. Halbouty. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1308–1329.—Until 1929 all production from the Jennings—or Evangeline—dome was from above the dome itself, there being no flank production. In 1928 leases were obtained on the south-east, north-east, and west flanks and drilling for deeper production commenced. At present only the south-east flank has proved productive.

A geophysical survey was undertaken to determine whether overhang is present and, if so, to what depth and extent. A modification of the standard refraction method (seismic) was used, a detector being placed at various points in a well near the flank of the dome and a series of shots fired for each new position. The results of the survey, used in conjunction with known geological evidence, indicate a combined overhang of cap-rock and salt of 1000 ft. on the south-east flank.

The production is from the middle Oligocene. The sands are irregular and are probably lenticular. There is no evidence of faulting. The producing zones are the Discorbis, Heterostegina, and Marginula, the last named only recently proving to be productive on the south-east flank.

S. E. C.

553.982 : 553(764)

106. Producing Horizons in Balcones Fault. New Chapter Written with Drill. J. W. Merritt. *Oil & Gas J.*, 19.12.35, **34** (31), 49–50.—About five years ago a belt of structures in Frio Co., Texas, was tested by several wells. The first was dry, but the second found good gas production in the Edwards. The third, near Pearsall, reached 10,050 ft., and in the Navarro at 3900 ft. had shows of oil and gas, which continued almost to the bottom of the hole. Two further wells were drilled to the Navarro which proved very successful oil-producers. Another well which was put down near the first dry hole encountered shows in the Navarro, and was continued to the Edwards, where sulphur water was reached. It was plugged back to the Buda, and completed for 2400 brls. per day.

The area is a plunging syncline the axis of which lies in a south-easterly direction, and forms the head of the Rio Grande Embayment. This regional monocline is interrupted by faults and anticlines of varying size. The surface dip ranges between 20° and 30°, and is generally southwards in Frio Co. and Northern Zavala Co., but changes to south-east, east, or north-east in Southern Zavala. The thickness of the beds increases towards the centre of the basin and the dip steepens with depth.

The work so far carried out has proved three separate structures and four possible producing horizons. It cannot yet be decided whether accumulation is mainly influenced by faulting or structure, although it may be a combination of both.

J. A. G.

553.982 : 553(764)

107. South Texas Reserves. E. S. Post. *Oil Weekly*, 25.11.35, **79** (11), 21.—The first important oil-field in South Texas was discovered in 1909, when drilling a water well, but the big discoveries came in 1921 with Luling and later Mirando. With few exceptions none of the south Texan fields has reached the stage of depletion. 70% of the wells are less than 3000 ft. deep.

Balcones fault zone: In this zone the Edwards line is the most prolific horizon. There are three major fields and a number of minor ones. The production is spotted and under hydraulic control, giving a recovery of 38,000 brls./acre. Recently production has been developed over serpentine plugs along the fault zone, but it is not so good as in the limes. A low production along this belt has also been obtained from the Navarro–Taylor sands, and one field has given Glenrose production.

At Mirando the production is mainly Jackson from sand lenses of a shore-line type, at depths of 1000–3000 ft. The recovery is about 8000 brls./acre.

Coastal Trend: This includes the Pettus district, the Trans-Salt Dome region, and the Rio Grande valley. Pettus production is mainly from the lower part of the Cockfield and the upper part of the Saline Bayou formation. Some gas is obtained from the upper part of the Jackson. The recovery is about 11,000 brls./acre, and the gas–oil ratio is rather high.

The Trans-Salt Dome region has some large producing structures with a number of oil and gas sand lenses. One well had as many as fifty sands offering possibilities in 10,000 ft., and production was taken from twenty.

Hill country north-west of San Antonio had two productive areas which were abandoned after a short time. The Hill country is speculative. Large structures occur which are expected to give production from Trinity, Pennsylvanian and Ordovician horizons. Many oil and gas shows do occur, and wells drilled to the Ordovician have shown oil.

A limited amount of exploration has indicated about a dozen salt domes west of the Trans-Salt dome region. Little drilling has been done there, but production has been established on two of them—the Piedras Pintas and the Palanga.

G. D. H.

553.982 : 553(825.1)

108. Report of the Geological Division. E. Fossa-Mancini. *Bol. Inform. Petroleras, (B.A.)*, Oct. 1935, **12** (134), 100–107.—This report deals with the petroliferous zone of Sosneado, in the province of Mendoza, Argentina. The zone is similar, in certain respects, to that of C. Rivadavia, but the folding and faulting have been accompanied or followed by intrusions and flows of andesitic magmas, of which two varieties have

been recognized by magnetometric methods. The flows mask the structure of a large part of the area, and increase the difficulties of geological and geophysical investigation to such an extent that no definite recommendations for exploitation can be made on the available data.

A map showing faulting and the areas covered by andesitic flows is included.

L. O.

Geophysics.

526.76 550.831

109. Field Measurements with a New Static Gravimeter. H. Haalck. *Oel und Kohle*, 1935, **11**, 851–853.—A field-scale Haalck apparatus is described and specimen results are discussed. Zero-shift, which is characteristic of instruments of this type, may be quickly corrected. The apparatus, mounted on a lorry, is halted at a place of known altitude, and measurements are made by two observers simultaneously. Each measurement takes 4 minutes, the mean accuracy of each result being $\pm$ 1 m.-gal.

P. G. H.

Drilling.

622.233.3 : 620.193

110. Corrosion of Drilling Plant. R. Fürst. *Bohrt. Ztg.*, 1935, 285.—The various theories relating to corrosion are discussed, the electrolytical theory explaining most of the phenomena. Remedies against the corrosion of oil-well boring apparatus are: sodium carbonate, cresolates, chromates, chromic acids, alkaline tannin solutions of sodium aluminate or silicate.

L. S.

622.242.2 : 621.313.1

111. Engine-Electric Rigs. W. C. Dreyer. *Oil Weekly*, 2.12.35, **79** (12), 25.—The proper selection of electrical equipment so that generator and motor sizes are balanced and able to operate the slush pumps will ensure fast hoisting. Reduced capacity operation and an assurance against shut downs are provided when duplicate apparatus is installed.

L. V. W. C.

622.243.7

112. Controlled Directional Well-Drilling and Surveying Practice. Part IV. J. D. Hughes. *Petr. Eng.*, Nov. 1935, **7** (11), 94.—A variety of deflecting tools and special bits for directional work are available, the geological and mechanical conditions determining the choice of the tool or bit to be used. Such tools as removable whipstocks, knuckle-joints, spinning spudders, hydraulicing bit and casing whipstock are generally used, with the removable whipstock the most popular owing to its simplicity and consistency of results. Variations in the whipstock have been made to meet certain conditions, but in soft formations a special type of spiral bit is used in conjunction with the whipstock, whilst in hard formations the spiral bit is replaced by a rock bit.

Normally three round trips are required to complete a whipstocking operation. These are orientation and drilling off, follow-up with special bit and reaming of rat hole to gauge.

Another tool which has been successfully used is the knuckle-joint. When this tool is run, considerable weight is applied the moment it reaches bottom to force the bit well into the formation, and so cause the string to angle at the universal joint and lie against the well.

A spinning spudder, similar to an automatic screw-driver, has been devised and used with some success.

L. V. W. C.

622.245.33

113. Evaluation of Rotary Drilling Muds. R. H. Jones and E. C. Babson. *Oil Weekly*, 2.12.35, **79** (12), 25.—A description is given of the apparatus used in the study of the flow characteristics of muds and of the performance of muds when circulated against artificial formations. The apparatus used was an adaptation of the MacMichael type of rotary viscosimeter.

The results of tests with the performance testing apparatus show that in most cases neither the pressure differential between the circulating mud and formations nor the apparent viscosity of the mud is of great importance in determining the rate at which the mud will lose water to formations, or in determining the thickness of the mud cakes deposited.

Temperature, however, is an important factor, the higher the temperature the more rapid will be the loss of water from mud to formations.

The selection and control of muds for use in difficult drilling projects can be made with sufficient accuracy by a test in the performance testing machine.

L. V. W. C.

622.243 : 608.3

114. Patents on Drilling Plant. T. N. Hunt. U.S.P. 2,019,978, 5.11.35. Retractable core barrel.

H. M. Grune. U.S.P. 2,020,410, 12.11.35. Safety detonating device for use in torpedoing wells.

L. A. Layne. U.S.P. 2,020,471, 12.11.35. Whipstock packer.

O. J. McCullough. U.S.P. 2,020,561, 12.11.35. Spear and releasable hammer.

F. F. Hill. U.S.P. 2,021,184, 19.11.35. Externally upset drill-pipe having uniform internal diameter.

F. J. Spang. U.S.P. 2,021,206, 19.11.35. Well packer.

W. L. Church. U.S.P. 2,021,223, 19.11.35. Packing anchor.

R. O. Anderson. U.S.P. 2,021,880, 26.11.35. Hydraulic brake for rotary drawworks.

B. McCollum. U.S.P. 2,021,943, 26.11.35. Seismic method for profilling geologic formations.

I. J. McCullough. U.S.P. 2,022,138, 26.11.35. Jarring tool.

O. B. Zeek. U.S.P. 2,022,267, 26.11.35. Protective device for casing-head drips.

E. L. Flemming. U.S.P. 2,022,713, 3.12.35. Counterbalance for walking beams.

G. J. Armstrong. U.S.P. 2,023,189, 3.12.35. Float valve.

J. A. Connolly. U.S.P. 2,023,724, 10.12.35. Measuring line for well plugs.

L. L. Mackowski. U.S.P. 2,023,930, 10.12.35. Shoe packer.

550.837 : 608.3

C. Schlumberger. U.S.P. 2,020,856, 12.11.35. Electrical core-taking device.

L. V. W. C.

Production.

532.522

115. Flow Through Submerged Orifices. J. Kunz. *Physics*, 1935, **6** (11), 351.—From the measurements of Giesecke on the flow of water through orifices a graph is plotted which enables the pressure loss to be estimated when the diaphragm is completely closed. It is shown that when this occurs the liquid flows back along the walls of the tube and forward in a central vein, the diameter of which is calculated for streamline and turbulent flow. It is shown that both the backward flow and the jet issuing from the orifice are unstable, and a simple experiment demonstrates that the latter may sometimes describe a spiral motion. P. D.

622.276.95

116. Compressed Air and Gas in Oil Production. R. von Zwerger. *Oel und Kohle*, 1935, **11**, 824–827 (see Abstract (**21**), Nos. 911, 1282).—Methods of effecting plunger-lift are described; the Hughes and Schweiger systems are compared. P. G. H.

622.276 : 608.3

117. Patents on Production Apparatus. H. N. Herrick. U.S.P. 2,020,550, 12.11.35. Well-pumping apparatus, using a gas lift at an intermediate point.

J. M. Hewgley. U.S.P. 2,021,997, 26.11.35. Fluid-operated lift for oil wells.

F. W. Taylor. U.S.P. 2,022,749, 3.12.35. Well-flowing device.

R. J. S. Pigate. U.S.P. 2,022,781, 3.12.35. Method of pumping oil hydraulically.

A. B. Herbsman and N. B. Currier. U.S.P. 2,022,859, 3.12.35. Deep well-pumping apparatus.

J. D. Spalding. U.S.P. 2,023,033, 3.12.35. Oil well control head.

L. V. W. C.

Pipe-Lines.

622.698

118. Controlling Paraffin in East Texas Gathering Lines. F. H. Love. *Petr. Eng.*, Nov. 1935, **7** (11), 33.—The common practice in the East Texas field for the elimination of paraffin from field lines is the regular use of scrapers. All lines and pump stations of one company have been constructed to permit scraper runs with the least possible interruption to regular operation.

The headers at all pumping stations are extended some distance beyond the limits of the station proper and into a concrete pit. The gravity line and the discharge line terminate in this sump, so that all lines and headers can be cleaned into it and the salvable oil recovered. Check valves are placed only on the tank battery headers, on the throws at tie-ins or on the pump manifold. From experience it has been found that the accumulation of paraffin is directly proportional to the length of the line and the volume of oil handled. The results of runs using this information were reduced to a given unit, and charts were drawn showing the frequency of runs through the gravity lines in order to use the static pressure of the tanks and line to propel the scraper.

L. V. W. C.

622.698

119. Tank Flow Hook-up. J. C. Albright. *Oil Weekly*, 25.11.35, **79** (11), 56.—Pennsylvania crude contains sufficient paraffin to congeal and flow with difficulty during the cold winter months. Heaters have, therefore, to be installed to warm the oil before and after it enters the tanks, so that it can be moved through the lines.

Heating coils are installed in the flow-tank batteries which automatically bring the oil up to a temperature sufficient to permit the pumps to move it through the pipe-lines.

The heat is obtained from the central power gas engines and exchanged into the cooling water circulating through the water-jacket.

A small coil and a small amount of heat are all that is needed to maintain fluidity of the oil.

L. V. W. C.

622.698 : 620.197

120. Pipe-Line Corrosion. Scott Ewing. *Oil & Gas J.*, 31.10.35, **34** (24), 32.—The Sub-committee on Pipe Coatings and Corrosion of the A.G.A. decided to remove the third of the four sets of coated pipe specimens buried in 1929. A full report on the pipes is not yet available, but it is believed that the results will confirm previous conclusions, indicating that a comparatively short-time test properly carried out is adequate. During the trip the Research Associate visited various gas companies and discussed coating and corrosion problems. When mill-coated pipe is laid, failures in the coating are especially likely to occur at the weld or near the edges of the coupling, where there is a tendency for the bitumen to be pressed thin by the overlying fabric. It is desirable to have the joints coated in the same manner as the rest of the pipe, but with felt reinforcement in the mill-wrapped coating it is generally desirable to use a woven fabric reinforcement at the joints because felts are difficult to apply by hand. Special containers and heaters using bottled gas for applying hot bitumen to joints on service and other small jobs are described.

In the Los Angeles area three large companies use different coating methods for recent installations, one using copper pipe, another asphalt with only a kraft paper shield, and the third used considerable quantities of Cellophane and Kodapak as reinforcing materials. The unreinforced asphalt coating is more resistant to moisture absorption and more stable chemically than the rag-felt reinforced coating previously used. Omission of felt is possible in this sandy soil, and by rapid cooling with the aid of air jets directed on the coated pipe as it passes through the machine, a thicker coating of asphalt is applied. Cellophane and Kodapak seem to serve the same purpose as felt, are cheaper and do not absorb as much moisture. A machine for

applying a layer of concrete 1 inch thick to a pipe-line at the rate of 1000 ft. per day is described.

The special methods applied by one company since 1913 in their efforts to combat corrosion are described and recommended for general application. Samples of soil from every opening and of every piece of pipe replaced were taken, and a report was made on all piping uncovered during the period, until a map showing areas where coating was unnecessary and areas where normal coatings or special protective methods were necessary had been prepared. Coating tests, etc., were also carried out. The possibility of electrolysis causing pipe failure must not be overlooked, especially in towns.

There seems to be a general tendency towards the more extensive use of adequate coatings, probably due to the influence of the research work carried out by the Bureau of Standards, the A.P.I. and the A.G.A. R. A. E.

Transport.

339.4 : 665.5

121. Distribution of Gasoline for Transport Purposes, as a Municipalizable Public Service. J. A. Celiz. *Bol. Inform. Petroleras* (*B.A.*), Oct. 1935, **12** (134), 27–37.—A study of a legal system that would assure the regularity, permanence, and cheapness of the gasoline supply.

The production and marketing of gasoline by the Government-controlled Y.P.F. have enabled the consumer to obtain gasoline at reasonable prices which are not subject to sudden fluctuations. This condition should be stabilized, and the possibility of doing this, legally, and in spite of the existence of concessions to individual companies, is explored.

It is concluded that the municipalization of gasoline distribution is legal and feasible. Legal precedents are quoted and methods of procedure outlined.

The suggested changes would not only have the immediate effect of assuring stability of price and cheapness, but would also ease traffic problems, make possible a rigid control of quality and measure, and allow economies to be introduced. L. O.

621.642.34

122. Evaporation Losses May be Cut in Half. Anon. *Nat. Petr. News*, 27.11.35, **27** (48), 25.—An investigation carried out by the U.S. Bureau of Mines at a bulk distribution plant has shown that the average loss due to the loss of gasoline vapours is, on average, approximately 1·5% of the volume handled. It is stated that if proper attention be given to suitable methods for reducing these losses the total loss may be reduced by 50%, representing a total saving of some 119,000,000 gallons. The various methods by which losses may be reduced are summarized under fourteen headings, the more important of which are: Vapour-tight tanks must be equipped with vapour-tight gauge and thief hatches and pressure relief valves of such flow capacity that distortion of tank roofs will be prevented under conditions producing a maximum strain. Welded tanks eliminate the possibility of the presence of the pinholes often present in riveted tanks. Emergency vent valves should be set at a pressure high enough to allow of the proper functioning of the relief valves used in normal operation. Breathing losses are reduced by maintaining pressure in a vapour-tight tank. Floating roofs are effective in reducing evaporation losses, although their efficiency is demonstrated only to the full on large capacity tanks. All tanks should be painted with light-coloured paint or covered by a housing which will allow the free passage of an air current around the tank. Under-surface filling greatly reduces loss during transference by leaving undisturbed the surface of the gasoline in the tank and the saturated layer of air above it. All these points are dealt with in detail. H. G.

629.123.24

123. Y.P.F. Increases its Fleet. Anon. *Bol. Inform. Petroleras* (*B.A.*), Nov. 1935, **12** (135), 49–53.—A description, with photographs, of the new Argentine tanker "13 de Diciembre," displacement 16,910 tons. L. O.

656.01

124. Co-ordination of Means of Transport. I. Ganitzchi. *Mon. Petr. Roum.*, 1935, **36**, 1531–1535, 1603–1609.—Reference is made to various publications sponsored by the "Chambre de Commerce Internationale" (C.C.I.) concerning road and rail transport in various countries. The author discusses various characteristics of rail and road transport in the following countries, recently published information being used: U.S.A., Canada, Mexico, Brazil, England, France, Belgium, Sweden, Norway, Denmark, Poland, Finland and Germany. W. E. J. B.

656.01 : 665.5

125. Transport Truck Loses Advantage over Railroad at about 180 Miles. A. S. James. *Nat. Petr. News*, 27.11.35, **27** (48), 18.—In the distribution of light oils, notably gasoline, the use of road tank cars shows an economic advantage over railcars provided the delivery point is not more than 90 miles from the distribution centre. This, of course, is for conditions obtaining in U.S.A. This conclusion follows from arguments comprising capital outlay on road tank cars, running costs, various taxes, considerations arising from State limits for the laden weight of tank cars, the useful life of equipment, a maximum possible daily mileage of 180 miles without changing drivers or involving a single driver in an overnight stop en route, and the prevailing charges for railroad haulage. The whole argument naturally devolves around the latter, since on a mileage basis they are much higher for short than for long hauls. H. G.

Crude Petroleum.

665.51 : 66(82)

126. Argentine Crude Oil. Anon. *Petr. Times*, 30.11.35, **34**, 598.—The article gives the properties and uses of the three Argentine crude oils which are available in commercial quantity. The three crudes are from (*a*) Chubut (Comodoro Rivadavia), (*b*) Neuquen (Plaza Huincul) and (*c*) Salta. An abridged list of their properties follows:—

	C.R.	P.H.	Sa.
Sp. Gr. at 15° C.	0·912–0·918	0·866	0·815
Viscosity S.U. at 70° F.	—	96 secs.	41 secs.
,, ,, 100° F.	530 secs.	63 ,,	37 ,,
Sulphur	0·2–0·9%	0·2%	0·1%
Paraffin Wax	1·6–2·0%	4·0%	2·7%

Direct distillation yields the following products:—

	C.R. % yield.	P.H. % yield.	Sa. % yield.
Gasoline	7	17	30
Kerosine	7	9	28
Gas Oil	14·5	20	27
Lub. Oil low viscosity	15	15	14
,, viscous	29	22	4
Asphalt	37	16	—
Octane No. of Gasoline	60	65–66	50

None of this gasoline is suitable for use as motor fuel, owing to its low octane rating. Cracking, however, yields suitable distillates for the rectification of the straight-run gasoline. Suitable cracking procedure produces the following yields: (*a*) C.R. 42%, (*b*) P.H. 40%, (*c*) Sa. 27%. The kerosine, which must be obtained by direct distillation, is stated to be paraffinic in character and of good quality. The lubricating oil from the Salta crude is of satisfactory viscosity index, but that from the others needs treatment by the solvent extraction process in order to yield an oil of satisfactory quality. H. G.

Chemistry of Petroleum.

547.31 : 546.268.5

127. Action of Thiocyanate on Unsaturated Hydrocarbons. M. A. Krassilchik. *Ann. des Comb. Liq.*, 1935, **10**, 923–987.—The author has studied the action of thiocyanate, in solution in glacial acetic acid, on a large number of unsaturated hydrocarbons. In general, satisfactory results are obtained, as substitution reactions do not occur. The addition reaction is quite regular, and reaction velocity constants can be calculated according to the bimolecular reaction formula. Two groups are found: those unsaturated hydrocarbons which do, and those which do not, give constants. All normal α olefins examined had the same velocity constant. Other unsaturated compounds, *e.g.* alcohols and acids, were examined. The effect of such active groups adjacent to the double linkage was to interfere with the reaction, but removal of these groups away from the double linkage causes the reaction to proceed as usual. Iodine, in glacial acetic acid, was not so good as thiocyanate. The method of working, which is fully explained, allows several applications, *e.g.* determination of the position of the double bond in the molecule, analysis of simple mixtures of hydrocarbons, identification purposes, etc. W. E. J. B.

542.942 : 546.264

128. Catalytic Reduction of Carbon Dioxide to Methane and Higher Hydrocarbons at Ordinary Pressures. F. Fischer, T. Bahr and A. Meusel. *Brenn.-Chem.*, 1935, **16**, 466–469.—Carbon dioxide in the presence of a ruthenium powder or asbestos catalyst is reduced to methane; the catalyst is superior to those previously known, but is not proof against hydrogen sulphide poisoning. By the addition of 2% of potassium carbonate to the catalyst and at temperatures from 170° C., there is obtained not only methane, but also higher gaseous and liquid hydrocarbons to a maximum C Number of 1·45 for the gas issuing from a reaction zone at 200° C. Rubidium carbonate behaves similarly, but the weaker alkalis are not effective. B. C. A.

547.21 : 536.423.1

129. Boiling Points of the Normal Paraffin Series. E. R. Cox. *Ind. Eng. Chem.*, 1935, **27**, 1423.—The survey described is part of a general plant to co-ordinate the vapour pressures of the paraffin by means of the formula: $\log P = \frac{A(t-b)}{T} = A\left(1 - \frac{B}{T}\right)$, where P is vapour pressure in atm., t is the corresponding temperature ° C., b is the boiling point ° C. and T and B are the same expressed as ° K.

It is shown that if methane and ethane be treated as separate problems, the remainder of the normal paraffin series can be reconciled by a simple equation—$\log B = 1{\cdot}07575 + 0{\cdot}949128 \log m - 0{\cdot}101 \log^2 m$, where B is the boiling point ° K and m is the approximate molecular weight. Taking the best observed values from propane to octane, with the exception of butane, the agreement is perfect. Beyond octane, deviations from the calculated values are marked, and when plotted against the number of carbon atoms (up to dodecane) they fall on a curve. It is seen that decomposition is perceptible for nonane and decane, distinct for undecane and dodecane, and increases rapidly for higher members of the series.

Reasons are given for believing that methane and ethane are not homologous with the rest of the series with regard to boiling point. These are: (*a*) that methane contains a C—H bond of unique strength not found elsewhere in the series, (*b*) that ethane contains a C—C bond of similar nature. Methane and ethane are not considered to be true homologues of the series with reference to other thermo-dynamic properties. Propane contains no bonds that are not duplicated in the higher members of the series. W. H. T.

547.21 : 536.63

130. Phase Equilibrium in Hydrocarbon Systems. Part 9. Specific Heats of *n*-Butane and Propane. B. N. Sage and W. N. Lacey. *Ind. Eng. Chem.*, 1935, **27**, 1484.—This paper, part of A.P.I. research project 37, presents specific heat results obtained by

methods applicable to gaseous and to 2-phase systems. Results for nearly pure *n*-butane at 70–220° F. are compared with those obtained by the method devised for liquid systems. Observations on propane are also presented. W. H. T.

547.541 : 547.551

131. Reactions of Mineral Oil Sulphonic Acids with Aromatic Amines. J. Sereda. *Ber.*, 1935, **68** (10), 1933–39.—On heating mineral oil sulphonic acids with aniline the principal product obtained was sulphanilic acid, viz. RSO_3H and $C_6H_5NH_2 \longrightarrow C_6H_4{\cdot}NH_2{\cdot}SO_3H$ and RH. It was found that this reaction was modified by the presence of sulphuric acid or its esters. Below 160° C. aniline sulphate was formed, and above this temperature sulphanilic acid. The same reaction was obtained with *o*- and *p*-toluidine, which gave respectively 2-aminotoluene-5-sulphonic acid and *p*-toluidinesulphate. The formation of amine sulphates showed that the reaction proceeds through the intermediate arylsulphaminic acid, which has not yet been isolated. The reaction between mineral oil sulphonic acids and aromatic amines results in a separation of a sulphonic group which migrates to the amine, but at the same time the amine may be partly converted into a diarylamine with evolution of ammonia. G. R. N.

665.58

132. Thermal Conversion of Synthetic Heavy Oil into Aromatic and Unsaturated Hydrocarbons. H. Pichler. *Brenn.-Chem.*, 1935, **16**, 404–406.—An oil b. p. 240–315° C. of paraffinic composition obtained in 10–20% of the total yield in the benzine synthesis of Fischer and Tropsch was subjected to heat treatment in a thin stream. In order to enhance the ratio of heating surface to reaction volume and to avoid overheating of the walls, narrow tubes were employed. A 75% yield of gaseous olefines, together with volatile liquid aromatic and unsaturated hydrocarbons, was obtained. The remaining 25% consisted of saturated gaseous hydrocarbons, undecomposed paraffin oil and aromatic tar. Excessive carbon deposition was avoided by control of the reaction conditions.

Below 500° C. the reaction is slow. Between 500 and 600° C. the reaction products noted result. Above 600° C. gaseous olefines predominate. For these the combination of high temperature and short reaction time leads to the best yields. For example, the yield rises from 20% by weight at 550° C. and 0·4 second contact time to 62% at 700° C. and 0·14 second. B. C. A.

665.58 547.29

133. Fatty Acids Produced in Small Quantities in the "Fischer and Tropsch" Benzine Synthesis. H. Koch, H. Pichler and H. Kölbel. *Brenn.-Chem.*, 1935, **16**, 382–387.—The use of a cobalt catalyst yields fatty acids amounting approximately to 0·35% by weight of the liquid hydrocarbons constituting the chief reaction product. The acids are for the most part dissolved in the water from the reaction, and by fractionation, formic, acetic, propimic and butyric acids may be detected. Acetic acid constitutes two-thirds of the mixture. Unsaturated acids are not detectable.

The fatty acids dissolved in the Kogasin amount to 0·06% by weight, and are principally acids with 5 to 10 carbon atoms in the molecule, but higher acids are present. B. C. A.

668.731 : 543.8

134. "Free Carbon" in Coal Tar. H. Mallison. *Asphalt u. Teer*, 1935, **35**, 1001–1003.—It has been known for some time that the so-called "free carbon" in coal tar is really a mixture of C compounds of high molecular weight. The nature and amount of insoluble matter obtained on treating tar with a solvent vary with the surface tension of the solvent. Elementary analyses are given of the insoluble in benzene from coal tar, and this insoluble matter was further separated into tar-resins soluble in hot pyridine, soluble in cold pyridine and insoluble in pyridine, analyses being given of each fraction. The C content is highest (93·4%) in the insoluble, whilst hydrogen is highest (4·06%) in the fraction soluble in cold pyridine. All fractions contain oxygen, sulphur and nitrogen, nitrogen being highest (1·5%) in the portion

soluble in cold pyridine, whilst oxygen is lowest in the insoluble in pyridine. In some respects the insoluble is similar to gas carbon, lamp-black, etc., comparative elementary analyses being tabulated. C. C.

668.746.4 : 66.092

135. Isomerization Phenomenon in Cracking Decalin with Aluminium Chloride. N. D. Zelinskii and M. B. Turova-Polyak. *J. Applied Chem.* (*U.S.S.R.*), 1934, **7**, 753–756.—Purified decalin was cracked by treatment with 10% aluminium chloride at 175–210° C. No gas was produced, the cracked products boiling between 80° and 180° C. As a result of the examination of these products it was concluded that the cracking caused isomerization of the 6-membered bicyclic nucleus. The *cis* form of decalin is first isomerized and is then transformed to a 5-membered bicyclic system. At the same time more severe transformations take place, *cyclo*pentane and *cyclo*hexane hydrocarbons being produced. Only traces of paraffins were obtained. The properties of the products of the reaction are tabulated. G. R. N.

Analysis and Testing.

532.13

136. Remarks on Use of Logarithmic Head Correction in Viscometry. G. Barr. *J.C.S.*, 1935, 1793–1795.—The application of Meissner's expression for the calculation of true mean head, when flow occurs under a gradually diminishing head, is considered to be inconvenient for most practical forms of viscometer bulbs. The author has rearranged the Meissner formula in the form

$$H\left(1 + \frac{I}{a}f^2 + \frac{1}{b}f^4 + \ldots\right) = h$$

where H = true mean head,
h = arithmetic mean head,
a, b = constants,
$f = \frac{x}{h}$, where x = half the difference between the initial and final heads.

Various values of a and b are given which apply to various forms of viscometer bulbs. The logarithmic mean head is important: (1) when external pressures are applied and the true mean head has to be estimated, and (2) when it is necessary to derive H from the dimensions of the apparatus.

The application of these equations to the calibration of Ostwald type viscometers is illustrated, as is its use for investigating "abnormal" liquids. W. E. J. B.

532.13 : 621.892.2

137. Viscosity of Oils, Diluted and Mixed. E. Erdheim. *Matt. Grasses*, 15.9.35, **10** (329), 600–602.—Three oils of viscosity index 87, 60 and — 20, respectively, and each of viscosity 109 cs. at 50° C., were variously diluted with light and heavy gasoline and kerosine. The viscosity–temperature curve of each of the twenty-seven mixtures obtained was determined. The results showed that: (i) the V.I. of the diluted oil was higher than that of the undiluted oil; (ii) the viscosity of the diluted oil could not be calculated by the Arrhenius rule; and (iii) the steeper the viscosity–temperature curve of the undiluted oil the greater is the loss of viscosity on dilution. In further experiments two paraffinic and one naphthenic oil were mixed in pairs, and the mixture viscosities determined at several temperatures. One paraffinic–naphthenic oil series of mixtures did not obey the Arrhenius rule, and it was suggested that in this case the two oils were mutually soluble rather than just mixed. G. R. N.

532.13 : 621.892.2

138. Pseudo-Plasticity in Mineral Oils. H. Weiss. *Oel und Kohle*, 1935, **11**, 811–815.—The apparent viscosity (η) of certain high-viscosity lubricating oils, kept continuously at 0° C., increased steadily with time. Periodical measurements were made in a calibrated pipette, filled each time under constant suction pressure. A limiting

value of η was reached after about 1 month. If the oil was pre-cooled at − 80° C. for ½ hour, η at 0° C. was very high at first, but gradually fell to the limiting value. In certain cases it was necessary to work at temperatures lower than 0° C. in order to observe this behaviour. η was found to be dependent on the suction pressure p; the curve $\frac{1}{T}$ against p, where T = filling time of pipette, was a curve lying below the straight line which is characteristic of a normal liquid. The curve makes an intercept (P) on the pressure axis, which, however, is not a true yield value; movement of the oil can be effected by pressures, less than P, which are given by the curve itself.

Since $T \times p$ is not constant, it is not characteristic of the liquid, but varies with the pressure which causes movement. The phenomenon is called pseudo-plasticity, since it refers to a state intermediate between that of a normal liquid and that of a substance exhibiting a true yield value. It is not caused by precipitation of solid at low temperature; certain oils were, in fact, found to show a gradual *decrease* in viscosity at 0° C. It is suggested that some molecular orientation occurs giving a state between a true liquid and a crystalline solid. The structure is easily destroyed; if the pipette is filled and emptied several times in rapid succession with oil which has been held at 0° C. for a long time, the apparent viscosity falls each time until the normal value is reached. The cooled oil thus appears to be thixotropic. Pre-treatment at 50° C., 80° C. or 100° C. lengthened the time required for steady η to be reached at 0° C., and increased P (pseudo-yield value).

The pseudo-plastic oil possessed elasticity, when tested by the torsion method.

With increasing diameter of capillary, P diminishes, and finally vanishes; thixotropy is stated to obscure pseudo-plasticity in this case. P. G. H.

532.13 : 665.5

139. Viscosity of Petroleum Products. R. E. Hirsh, E. K. Fisher and M. R. Fenske. *Ind. Eng. Chem.*, 1935, **27**, 1441.—The kinematic viscosities at 210° and 100° F. of a large number of closely fractionated, blended and commercial grades of Pennsylvanian oils. The relation between kinematic viscosity at 100° F. (KV_{100}) and that at 210° F. (KV_{210}) is expressed by the equation—

$$KV_{100} = 2{\cdot}808\left[KV_{210} - \frac{0{\cdot}500}{(KV_{210})^{1{\cdot}25}}\right]^{1{\cdot}5}$$

From existing data, a similar equation is derived for typical naphthenic oils

$$KV_{100} = 2{\cdot}450\left[KV_{210} - \frac{0{\cdot}213}{(KV_{210})^{1{\cdot}36}}\right]^{1{\cdot}8}$$

On the basis of these equations, complete viscosity–index tables have been constructed, the results being expressed in absolute-viscosity units. W. H. T.

532.13 : 665.5

140. Accuracy of Viscosities Measured in Engler Degrees. F. H. Garner and W. E. J. Broom. *Rev. Petr.*, 21.9.35 (649), 1204–1205.—Discusses the results obtained by eight laboratories in determining the viscosities of ten oils at 25°, 50° and 100° C. by means of the Engler viscometer. There were considerable differences between the results from lab. to lab. and from the standard mean error of all the results taken together. Each viscometer appeared to give a consistent error in relation to the standard mean. The viscosities of the more viscous oils were also determined in B.S.I. tube viscometers and converted to Engler degrees by means of Vogel's formula. The agreement was extremely good, indicating the reliability of this formula. In conclusion, it is suggested that a master Engler viscometer should be set up as a standard, and that water is not a suitable liquid for calibration of ordinary Engler viscometers. G. R. N.

532.13 : 665.5

141. New Method for Determining Viscosity Index. W. Setkowicz. *Przem. Naft.*, 1935, **10** (24), 733–734.—The Dean–Davis method is unsuitable for use with the

Engler and Vogel–Ossag viscometers, so the author has modified this method as follows for Continental use. The relation between the viscosities of an oil at two temperatures is $y = a + bx + cx^2$, which becomes

$$\left.\begin{aligned} y &= 0{\cdot}10325x^2 + 5{\cdot}2003x - 12{\cdot}39 \text{ (series H)} \\ y &= 0{\cdot}31247x^2 + 6{\cdot}476x - 20{\cdot}41 \text{ (series L)} \end{aligned}\right\} \text{ for kinematic viscosity at } 50° \text{ and } 100° \text{ C.,}$$

and

$$\left.\begin{aligned} y &= 0{\cdot}39666x^2 + 8{\cdot}6894x - 10{\cdot}573 \text{ (Series H)} \\ y &= 1{\cdot}9317x^2 + 10{\cdot}976x - 16{\cdot}433 \text{ (Series L)} \end{aligned}\right\} \text{ for Engler viscosity at } 50° \text{ and } 100° \text{ C.}$$

Tables based on the above formulæ were drawn up to cover the ranges 5–33 cs. and 1·40–4·50 degrees Engler. To calculate the viscosity index of an oil its viscosities at 50° and 100° C. were determined, and the usual formula, *i.e.* $\frac{L - U}{L - H} \times 100$, was applied, where U was the viscosity at 50° C. G. R. N.

542.48 : 665.5

142. Laboratory Vacuum Distillation Unit and Laboratory Seven-Stage Counter-Current Treating Apparatus. H. Moore. *J.I.P.T.*, 1935, **21**, 993–994.—A short description of (i) a 4-litre still equipped with an electrically heated packed column and (ii) a seven-stage lab. apparatus working counter-current and primarily designed for solvent refining. G. R. N.

547.53 : 545.81

143. Microcolorimetric Method for the Determination of Benzene. H. H. Schrenk, S. J. Pearce and W. P. Yant. *Fuel*, 1936, **15** (1), 4–8, reprinted from U.S. Bureau of Mines, R.I. 3287.—A colorimetric quantitative method for the determination of small amounts of benzene in vapour or liquid phase is described. The method is based on the reddish-purple colour produced by *m*-dinitrobenzene in the presence of butanone and sodium hydroxide. The benzene, in liquid or vapour phase, is nitrated to *m*-dinitrobenzene with a mixture of fuming nitric and sulphuric acids. The acid mixture is neutralized, extracted with one 10 ml. portion of butanone and 1·5 ml. of 40% sodium hydroxide solution added to the butanone extract. As little as 0·001 mgms. of benzene may be determined by this method. The accuracy is 5% in the range of 0·01–0·06 mgms. of benzene, and the method can be applied in the presence of toluene. W. S. E. C.

621.327.31 : 544.8 **544.8 : 665.4**

144. Application of the Quartz Lamp to Analysis in the Mineral Oil Industry. A. Balada. *Petr. Zeit.*, 4.12.35, **31** (48), 11–12.—The two principal uses of the quartz lamp are: (1) as a means of artificially ageing oils to indicate the degree of stability, especially of paraffin wax, and (2) to differentiate between products of different qualities, different chemical composition and degrees of refining. Reference is made to the work of Bruckner and Mimhard on the components of different types of bitumen under ultra-violet light, also that of Macht on the examination of asphalt and tar by means of the quartz lamp, to Hradel on fluorescent spectrographic investigation of bitumen and to Dangl on luminescence analysis of petroleum.

The analysis is carried out by examining the luminescence of the oil in direct and transmitted light when placed in a glass vessel, on a glass-plate or on a non-fluorescent filter paper. Generally, the fluorescent colour of naphthenic base oils is blue, of asphaltic base oils brown, and of paraffinic oils yellowish-white, *e.g.* Pennsylvanian cylinder oil. A greyish tint in the fluorescence usually denotes the presence of impurities.

The Fanto Works A.G., at Pardubice, has detected hard asphalt in cylinder oils by comparing these with a standard sample. Oils of the same origin gave results to 0·01% accuracy and oils of varied origin gave results to 0·1%.

Analyses show that an oil of blue fluorescence changes slowly to a bright yellow, and appears less bright up to an asphalt content of 0·40%, when the blue colour disappears.

Another application of the quartz lamp is for the detection of graphite particles in lubricating oils; these are black under the quartz lamp. The degree of ageing can be determined by comparison with a standard oil, taking care that no impurities

are present. A drop of the oil placed on filter paper to which a drop of benzole has been added exhibits a brownish-black colour. W. S. E. C.

621.892.2 : 620.1

145. Experiments with the S.A.E. Oil-Testing Machine. E. H. Kadmer. *Oel und Kohle*, 1935, **11**, 956–959.—The work carried out by Wolf and Mougey (*Oil & Gas J.*, 17.11.32, **31** (28), 58) on polar extreme pressure lubricants has been extended by the author to include mineral-oil raffinates and special chemical products. No relation could be discovered between sulphur content and film-strength in sulphurized lubricants. Chlorine had a favourable effect, whilst lead soaps, in conjunction with sulphur, were detrimental. The load-carrying capacity of mineral oils decreases with increasing degree of refining; viscosity has practically no effect on film-strength. It was observed that tin lactate, synthetic resin oil, and cup-grease all showed good film-strength when used alone as lubricants. P. G. H.

665.52

146. Characterization of Petroleum Fractions. K. M. Watson, E. F. Nelson and G. B. Murphy. *Ind. Eng. Chem.*, 1935, **27**, 1460.—Empirically developed charts are presented which relate the Universal Oil Products' characterization factor K (ratio of the cube root of the average boiling point in ° Rankine to specific gravity at 60° F.) with specific gravity, boiling point, viscosity, aniline point, viscosity index and hydrogen contents of petroleum fractions. The value of the characterization factor ranges from 12·5 to 13·0 for purely paraffinic stocks to 10·0 or less for aromatic materials. If for any particular stock two of the above properties are known, the others may be more or less satisfactorily approximated. The most satisfactory correlations are based on determinations of specific gravity and either average boiling point or viscosity at 210° F. These determinations permit prediction of the other properties with fair approximation for use in engineering (*e.g.* cracking) problems. A large number of cuts of widely different origins, average boiling points and widths of boiling range were collected and the results of determinations on all fractions have been tabulated. The relationship between the various properties (*i.e.* kinematic viscosity/°A.P.I., mol. average boiling point/°A.P.I., critical temp./°A.P.I., characterization factor K/aniline point, *K*/viscosity index and *K*/hydrogen content), is shown by means of charts. W. H. T.

665.521.2 : 536.423.15

147. Estimated Reid Vapour Pressure from A.S.T.M. Distillation Data. H. M. Trimble and J. O. Richardson. *Refiner*, 1935, **14**, 562.—Using data on 800 samples, selected to cover all seasons of the year and all types of gasoline, but with Reid vapour pressure of less than 15 lb., a nomograph and an alternative chart have been compiled, which permit the estimation of Reid vapour pressure from the 5 and 20% evaporated temperatures. B. C. A.

667.624.62 : 620.1

148. A Test for the Water-Resisting Properties of Paints for Steelwork. L. P. McHatton. *J.I.P.T.*, 1935, **21**, 989–992.—Describes initial experiments on two electrical methods to assess the water resistance of paint films on steel. G. R. N.

Cracking.

665.58 : 66.092

149. Cracking of Coal Oils. Anon. *Petr. Times*, 16.11.35, **34**, 521.—A number of tests have been carried out on a pilot plant of the Dubbs Multiple Cycle Type in which the charging stock was the distillate obtained from the Cannock process of low-temperature carbonization of coal. The cracked residuum was recycled with fresh coal and "make-up" oil. For comparison's sake, creosote and distillates produced from shales and lignites were treated. The results have shown that Cannock process distillates are eminently suitable for treatment. The conclusions are summarized:

(*a*) That the whole of the stock is "crackable," and that the yields of gasoline, gas of high calorific value, and residuum suitable for recycling are entirely satisfactory. (*b*) The minimum yields of gasoline to be reasonably expected are: (1) from simple topping of the distillate 15 gals./ton; (2) from cracking the whole of the residual distillate 58 gals./ton; (3) from stripping the total gases 5 gals./ton. (*c*) The properties of such gasoline would be as follows: I.B.P. 35° C., boiling to 100° C., 15-18%, F.B.P. 210° C. Gum and sulphur—satisfactory, Octane No. (Motor Method) over 80. Sp. Gr. at 60° F. 0·9, phenols and tar acids—as desired. (*d*) The final coke produced would be premium smokeless fuel of calorific value 10–20% higher than those manufactured at present and containing less ash. (*e*) The gases are eminently satisfactory for dehydrogenation and subsequent polymerization. H. G.

Hydrogenation.

662.743

150. Development of Coal Hydrogenation. K. Gordon. *Engineer*, 1935, **160**, 576–578, 604–606.—The chemistry of hydrogenation is briefly summarized and followed by an outline of the history of the hydrogenation of coal to form liquid products.

The work of the I.C.I. in developing the process of hydrogenation is described, with mention of the early experimental plants and the research programme on the investigation of catalysts.

The pilot plant erected at Billingham in 1929 is outlined, with a discussion on its operation and the quantity and nature of the products obtained. Diagrams are given to show the circulation of the various materials through the different sections of the plant.

After the signing of the I.H.P. agreement, improved designs became available, based on experience at Billingham and associates in the I.H.P., and following the announcement of the British Hydrocarbon Oils Production Bill in July 1933, the I.C.I. sanctioned the construction of a large-scale plant to produce 100,000 tons of petrol a year. The rated throughput of this plant was later increased to 150,000 tons a year.

The construction and starting up of the above plant are described, and flow sheets and details of its operation are also given.

It is estimated that the new plant will produce 1 ton of petrol from 3½ to 4 tons of raw coal, excluding the coal necessary for the production of hydrogen. Taking everything into account, the plant will produce 1 ton of petrol from 5 tons of coal.

It is shown that products can be produced to conform with current specifications for No. 1 spirit, ethyl spirit, and the Air Ministry's latest aviation spirit specification of 87 octane number. A table of the analytical data for these spirits is given.

J. G. W.

66.094.1 : 608.3

151. Patents on Hydrogenation. Int. Hydn. Pats. Co. E.P. 438,084, 11.11.35. Hydrogenation in the presence of a metal (not sodium or potassium) halide catalyst and the same halide or hydrogen halide as is contained in the halide.

Int. Hydn. Pats. Co. E.P. 439,314, 4.12.35. Preparation of anti-knock fuels from middle oils by catalytic hydrogenation at 400–430° C. The product is freed from low-boiling components (below 100–125° C.) and heat treated so that a product poorer in hydrogen is obtained without the molecular weight of the bulk of the final products being changed.

I.G. Farbenind. A.-G. E.P. 439,366, 5.12.35. Catalytic hydrogenation of asphalt-free carbonaceous materials in which they are treated with acids so that only organic nitrogen bases are dissolved and unsaturated hydrocarbons are unattacked prior to hydrogenation.

Univ. Oil Prods. E.P. 439,430, 6.12.35. Hot cracked residue is mixed with an alkaline material and a metal, capable of reacting with each other, to form sufficient nascent hydrogen to saturate, fully or partly, the unsaturated components of the residue. The heat required for the reaction is contained in the cracked residue.

W. H. T.

Fr. Krupp A.G. Austr. P. 143,620, 27.11.33. Vessels resistant to hydrogen at high temperatures are constructed of Ti-containing steel alloys, the Ti-content being at least four times that of the C present.

Austr. P. 143,623. Steel alloys for the same purpose, containing Vd, Nb, Ta (at least four times as much as the C present). L. S.

Polymerization.

542.952.6 : 547.313

152. Mechanism of Olefine Polymerization. G. Egloff. *Nat. Petr. News*, 20.11.35, 27 (47), 65.—Sundry discussions relative to the mechanism of the polymerization of olefines to hydrocarbons of the gasoline type are reviewed. One of the earliest theories postulated the production of acetylene from ethylene and the polymerization of the former body to benzene. This theory has been criticized on the ground that at no stage can acetylene be detected. A second suggestion is that at high temperature ethylene is dehydrogenated with the production of free radicles able to combine in ring formation to benzene: $HCH=HCH \longrightarrow 2CH\equiv + H_2$.

Butene and butadiene are found in appreciable quantities under certain conditions, and this fact is made use of in the suggestion that polymerization occurs by the relatively easy stages of intermediate products. Many theories are based on the assumption of the production of free radicles, a mechanism which receives some support from free energy considerations. In general, however, the course of the reaction would appear to depend largely on the operating conditions. In the case of catalytic polymerization—in the presence of phosphoric acid, for instance—the production of aromatics from olefines is explained thus: 1. The formation of ethyl phosphates; 2. the decomposition of these esters to yield polymers and naphthenes; 3. the dehydrogenation of naphthenes to aromatic hydrocarbons; 4. the hydrogenation of olefines to paraffins by the "nascent" hydrogen from the naphthenes. In the presence of aluminium chloride, olefines polymerize to dimers or lubricating oil hydrocarbons, according to the conditions. Pure aluminium chloride appears to be inactive. Only in the presence of moisture, and therefore HCl, does aluminium chloride function as a catalyst, and the rôle of the salt is questioned. In order to explain the accelerating effect of oxygen the formation of an intermediate oxide has been postulated. This decomposes to form bivalent radicles with two or more C atoms:

$$H_2C{=}CH_2 + O_2 \longrightarrow O{=}O\begin{matrix}CH_2\\CH_2\end{matrix} \longrightarrow \begin{matrix}-CH_2\\|\\-CH_2\end{matrix} + O_2$$

H. G.

66.095.26 : 547.313

153. Variation of the Operating Conditions Changes the Properties of Polymerized Fuel. M. B. Cooke, H. R. Swanson and C. R. Wagner. *Nat. Petr. News*, 20.11.35, 27 (47), 33.—The polymerization of unsaturated hydrocarbons is generally considered to be a bimolecular reaction in which the reaction velocity constant K is expressed by the equation $K = \frac{X}{at(a-x)}$, where t = reaction time, a = the reactant at t_0 and x = proportion of reactant converted at t_x. The earlier literature indicates that temperatures of the order of 1500–2000° F. are necessary for the polymerization of unsaturated hydrocarbons to aromatics. A consideration of free energy relationships shows that certain olefines of low molecular weight should polymerize to aromatic bodies at temperatures as low as 800° F. When operating at low temperature and high pressure, a minimum of intra-molecular rearrangement occurs, and the resultant products contain a relatively high proportion of unsaturated bodies. High-temperature/low-pressure operation, on the other hand, produces distillates high in cyclic bodies. The yield, in the latter case, is lower, but this is more than compensated for by the better quality. The present trend is for still higher temperatures and lower pressures. Tables are submitted giving the operating data and the properties of the products of typical plant runs. These show, for instance, that with a stabilizer overhead gas containing 80% unsaturateds and working at 1175° F. and 55 lb. pressure, "once-through" operation gives a conversion of 80% wt. of the charge. The

yield of 350° E.P. gasoline is 9·8 gallons per 10^3 cu. ft. gas. The volume of the stripped gas is half that of the volume charged, and its content of unsaturateds 35%. Valuing the gas treated on the basis of its equivalent in heavy fuel oil, fuel being the only alternative use for the gas, the production cost of polymer gasoline is given as 5 cents per gallon. H. G.

66.095.26 : 665.521.1

154. Polymerization, a Tool of Great Economic Utility. G. Egloff. *Nat. Petr. News*, 20.11.35, **27** (47), 25.—The polymerization of waste refinery gases and natural gas is an established commercial possibility. The potential yield of polymer gasoline from waste refinery gases alone in 1935 was 9×10^9 gallons. Polymer gasoline has remarkable properties, and it portends far-reaching effects in the industry. Its high blending value octane number of 100–125 will considerably decrease the need for tetraethyl lead. When I.C. engines able to make use of the much higher octane number are produced, the lower rate of consumption will produce notable changes in the transport and aviation industries. Polymerization involves the synthesis of unsaturated molecules only, and paraffins can be polymerized only after dehydrogenation. The former reaction is exothermic, the latter endothermic, and while processes are available which permit the two to proceed simultaneously, such processes are inferior to those in which the two steps are carried out separately. A typical catalytic polymerization process is described and discussed. The catalyst is solid phosphoric acid, which would appear to be almost the perfect catalyst. It is cheap, solid, non-corrosive, non-poisonous, is "poisoned" only with difficulty and regenerated, at comparatively long intervals, by simple means without removal from the plant. Polymerization offers a ready means for the cheap production of *iso*-octane. *iso*-Butylene, from stabilizing cracked gasoline, is polymerized to di*iso*butylene, which is hydrogenated to *iso*-octane. The potential production of *iso*-octane in the U.S.A. is 10^9 gallons per annum. H. G.

66.095.26 : 665.521.1 : 657.472

155. Costs of the Polymerization of Refinery and Natural Gases. A. L. Foster. *Nat. Petr. News*, 20.11.35, **27** (47), 22.—The article comprises abstracts and comments on certain papers presented at the meetings of the refining technical division of the A.P.I. The cost of polymer gasoline is given as 3–5 cents per gallon, but it is not clear if this figure includes all "overhead" charges. The relative merits of catalytic and straight pyrolysis processes are dealt with. The former appear to be cheaper, but the latter have the wider range of application. Certain low gravity products are available which contain 95% aromatics, and are therefore satisfactory alternatives to the coal-tar products used for nitration. Oiliness and tests designed to measure or assess it are dealt with, as is the use of addition products to increase oiliness. In this connection an interesting theory is cited by which "wear" in an internal-combustion engine cylinder is attributed to corrosion by products of combustion. The theory is that oiliness dopes reduce this "wear" by producing a protective film on the cylinder wall. H. G.

Gas.

662.76 : 608.3

156. Patents on Gas. A. T. Stuart. E.P. 437,570, 31.10.35. Combustible gas of constant characteristics is prepared by electrolysing water, using the oxygen so produced to gasify solid or liquid fuel, the hydrogen being carburetted and "weighted" with atmospheric nitrogen to a heat value, and specific gravity similar to the former gas. The two gases are then mixed. W. H. T.

66.074.38 : 608.3

N.V. Machineriën en Apparaten Fabriker Meaf. E.P. 439,772, 13.12.35. Process for washing light hydrocarbons and naphthalene out of gases in a single operation. The gas is washed with a washing oil cooled below 0° C., which absorbs benzole and naphthalene. The hydrocarbons are continuously expelled from the washing oil

by heating and evaporation, while naphthalene, together with moisture, are continuously removed from the washing oil by crystallization. The washing oil is then recooled and used again. W. S. E. C.

665.58 : 608.3

F. Winkler and H. Haeuber. U.S.P. 1,986,238–9, 1.1.35. Conversion of normally gaseous hydrocarbons by heat treatment at 400–1100° C., in admixture with 2% by vol. of mercury vapour. In U.S.P. 1,986,239, the mercury vapour is replaced by 0·01% cadmium vapour.

547.313 : 66.074.57 : 608.3

B. T. Brooks. U.S.P. 1,988,479, 22.1.35. Diolefines are separated from olefines by contacting at below 10° C. with solid cuprous chloride dispersed in an aqueous solution associated with a chloride of an amine.

547.313 : 66.095.3 : 608.3

V. Ipatieff and A. V. Grosse. U.S.P. 1,994,249, 12.3.35. Gas mixtures containing ethylene and olefines of higher molecular weight are subjected to the action of aromatic hydrocarbons in the presence of sulphuric acid, in order to condense the higher molecular weight olefines with the aromatics. Condensation of the ethylene is effected by the addition of more aromatics.

665.58 : 608.3

F. Winkler and P. Feiler. U.S.P. 1,995,136, 19.3.35. Vaporized hydrocarbons are heated in order to effect a 5% conversion into olefines, and the product is subjected to incomplete combustion at above 1000° C. Hydrocarbons richer in carbon are thus obtained.

665.58 : 608.3

H. M. Smith. U.S.P. 1,995,330, 26.3.35. Thermal decomposition of gases followed by catalytic hydrogenation in order to obtain the optimum yield of aromatics.

66.095.26 : 608.3

W. Herbert. U.S.P. 1,997,145, 9.4.35. Polymerization of gases by passage through solid adsorptive media.

547.313 : 66.095.26 : 608.3

S. Lenher. U.S.P. 2,000,964, 14.5.35. Polymerization of monolefines, having less than 10 carbon atoms, at 400–700° C. to form those of greater molecular weight. The gas is mixed with 0·5–5% of oxygen prior to heat treatment.

547.313 : 66.074.7 : 608.3

W. Engs and R. Moravec. U.S.P. 2,007,159, 9.7.35. Continuous selective removal of tertiary base olefines from hydrocarbon mixtures using an acid absorbent.

547.313 : 66.095.26 : 608.3

G. Ebert. U.S.P. 2,008,491, 16.7.35. Polymerization of diolefines by contacting with an alkali metal and an unsaturated ether having an olefinic double carbon bond in the molecule.

547.313 : 608.3

A. T. Larson. U.S.P. 2,014,740, 17.9.35. Olefines and steam are reacted in the vapour phase and in the presence of a volatile halide and an adsorbent, in order to produce a compound containing a hydroxyl group directly linked with an alkyl group.

547.313 : 608.3

R. M. Isham. U.S.P. 2,014,766, 17.9.35. Naphthalene and a sulphonic acid are reacted at 80–130° C. with an olefine and propylated naphthalene is recovered.

547.31 : 66.093.4 : 668.3

G. F. Horsley. U.S.P. 2,015,073, 24.9.35. Catalytic hydration of unsaturated hydrocarbons at 100 atm. and 290° C. in the presence of metaphosphates of divalent and trivalent metals (*e.g.* ferrous and ferric phosphates).

547.313 : 66.093.4 : 668.3

H. Dreyfus. U.S.P. 2,015,105, 24.9.35. Hydration products of olefines are obtained by contacting the latter with a mineral acid of low volatility and an alcohol containing a plurality of hydroxyl groups.

547.31 : 66.073.7 : 668.3

G. F. Horsley. U.S.P. 2,015,223, 24.9.35. A cyclic process for enriching in ethylene, a gas mixture consisting of ethylene and propylene. The gas is washed under pressure with a mineral-oil fraction (b. p. above 200° C.), oil is separated, the pressure is released in stages and the gas from the first stage is recycled.

W. H. T.

Motor Fuels.

662.753.1 : 621.43.019.8

157. Nature of the Octane Scale. E. B. Evans, E. M. Dodds and F. H. Garner. *J.I.P.T.*, 1935, **21**, 1000–1012.—An account of experiments on the determination of the pressure of incipient knock under standard conditions in standard engines and the use of the results obtained to give octane number values in the regions of 85–100 and 100 plus.

G. R. N.

665.521.23

158. Contribution to the Study of the Manufacture of Aviation Spirit of High Anti-Detonant Value. R. Carrozzi. *Bol. Inform. Petroleras (B.A.)*, Nov. 1935, **12** (135), 55–60.—Aviation gasoline, with high anti-detonating characteristics, is obtained, usually, by doping with lead tetraethyl, or by the addition of absolute alcohol or benzole.

In circumstances of emergency in Argentina, lead tetraethyl could not be obtained with certainty, as it is manufactured in U.S.A., so that, failing its supply, the addition of absolute alcohol offers the only domestic means, at present available, of providing non-pinking spirit for high-compression motors.

Cracked spirit possesses high anti-detonant properties, but its employment has been excluded, up to the present, owing to its instability and liability to form gum. Ways and means of obtaining a non-gumming cracked spirit are indicated and discussed. It is concluded that the use of highly-refined cracked spirit is feasible in motors in which the intake temperature does not exceed 65–70° C.

L. O.

662.758.2 : 668.3

159. Patents on Motor Spirit. P. Buti. E.P. 437,484, 25.10.35. A fuel comprising a mixture of an alcohol with a hydrocarbon distillate (b. p. 70–100° C.).

665.521.2 : 668.3

Bat. Petm. Mij. E.P. 437,864, 6.11.35. Vapour-phase refining of motor fuel containing a high percentage of unsaturated components, using a hydrocarbon sulphonic acid suspended in an inert organic medium as the refining agent. The vapour is mixed with steam during treatment.

665.521.2 : 66.074.37 : 668.3

N. D. Zelinskii and I. N. Titz. E.P. 438,354, 12.11.35. Desulphurization of crude benzene, etc., containing sulphur, by vapour-phase treatment with nickel deposited on aluminium hydroxide in the presence of hydrogen at below 350° C.

665.58 : 668.3

I.G. Farbenind. A.-G. E.P. 438,548, 19.11.35. Production of polymerization products of acetylene using an acid cuprous salt solution containing salts of the alkali or alkaline-earth metals as the catalyst. The solution should be free from nitrogen bases or thio. salts.

665.521.2 : 66.074 : 608.3

I.G. Farbenind. A.-G. E.P. 438,810, 25.11.35. Hydrocarbon mixtures containing dienes are purified by treatment with maleic acid anhydride or maleic acid. Addition compounds of the acid or anhydride with the dienes are formed and separated.

665.58 : 608.3

C. M. Cawley and J. G. King. E.P. 438,811, 25.11.35. Motor spirit and lubricating oils are obtained by the hydrogenation of rubber, gutta percha, etc., under pressure at 360–400° C. in the presence of molybdenum sulphide supported on a carrier such as alumina gel.

665.58 : 608.3

J. E. Hackford. E.P. 439,036, 29.11.35. Production of motor spirit from coal-tar oils by vapour-phase cracking. Naphthalene is separated from the cracked residues and the latter recycled in admixture with fresh stock.

665.521.2 : 66.074 : 608.3

C. W. Stratford. E.P. 439,250, 3.12.35. Multi-stage acid treatment with centrifugal separation of acid tar between the stages. A final continuous treatment with doctor solution is given.

W. H. T.

Lubricants.

621.892.097

160. Crankcase Oil Improved by "Dope" after Extensive Research and Tests. Anon. *Nat. Petr. News*, 13.11.27, **27** (46), 38.—On the assumption that the efficiency of a lubricant could be increased by the formation of the adsorbed film of an added agent on the bearing surface, an investigation has been carried out to discover such an agent. Since the high polarity of the fatty acids renders the latter suitable for the formation of such a film, attempts were made to increase the polarity of the fatty acid while overcoming the disadvantages possessed by that class of body. Methyl-$\alpha\alpha$-dichlorostearate has been chosen from among the many reagents tested. Data from Timken film strength and Almen film strength and wear tests are given. These show that this dope is not the most efficient possible. However, it is necessary that the "dope" shall have no sensible effect on the other physical properties of the oil, that it shall be completely miscible with the oil and not increase sludging, oxidation, or affect stability. The suggested reagent is claimed to possess all these characteristics.

H. G.

621.892.2

161. Wetting Capacity of Lubricants. F. Irauth and E. Neymann. *Petr. Zeit.*, 14.12.35, **31** (49), 1–8.—The capacity of wetting of oils for iron is discussed. Saturated oils, *e.g.* Pennsylvanian oils and some oils as a result of refining treatment, *e.g.* white oils, possess this property; unsaturated compounds of polar characteristics which are present in the oil are not prone to this wetting effect. Generally, the wetting factor of the oil for iron decreases in the case of naturally uncompounded oils, with increasing degree of saturation and increasing viscosity index. Oils exhibiting a steep viscosity/temperature curve possess a high wetting capacity towards metal surfaces.

The facility of an oil to form a film with iron powder can be considerably increased by adding 0·05–0·1% of compounds containing polar groups, *e.g.* β-naphthol. The quantity and quality of these compounds are dependent on the fact that the maximum wetting factor is attained when the viscosity index remains unchanged.

W. S. E. C.

621.892.2 : 621.96

162. Sulphurized Cutting Oils. E. Robbe. *Matt. Grasses*, 15.11.35, **10** (331), 651–652.—Shortly discusses the essential requirements of a cutting oil, indicating the beneficial effects that may be obtained with the use of a sulphur. A cutting oil that

had proved satisfactory in use contained 94% mineral oil, 5% fatty oil and 1% sulphur and had a viscosity of 12 cs. at 50° C. Three recipes are given for the preparation of compounded and straight sulphurized cutting oils. G. R. N.

621.892.8

163. Effect of Age-inhibiting Additions to Mineral Lubricating Oils. H. Suida and P. Franchetti. *Petr. Zeit.*, 14.12.35, **31** (49); *Motorenbetrieb*, **8** (12), 2–5.—This work was carried out on three raffinates of different origin, *i.e.* Pennsylvanian, Columbian and Rumanian oils. These were analysed for acids, petroleum constituents, petroleum resins, asphaltic resins and hard asphalt before and after ageing, and after ageing with inhibitors. The oils were aged by maintaining them in an iron rotary autoclave for 40 hrs. at 120° C. and under 8 atmospheres pressure. The following compounds were investigated for inhibiting effects: pure phenol, cresol, pyrogallol, *p*-aminophenol, formyl-α-naphthylamine, sodium stearate, naphthenate and oxynaphthenate, tin stearate, naphthenate and oxynaphthenate, tin oleate, etc.

It was found necessary to add freshly prepared and carefully dried tin soaps in a finely-divided condition while slowly stirring and heating the oils. The oils were then filtered before use.

Generally, resins were formed in oils of high water content, but those of low water content initially were less inclined to sludge formation, since those constituents containing only small quantities of water maintained the sludge in solution. Asphaltic resins were also formed in the aromatic portion. W. S. E. C.

621.899

164. Purification of Used Lubricating Oils. Y. Renouil. *Olii Min.*, 1935, **15**, 129–130.—A brief summary is given of the impurities normally present in used oils (transformer oils and lubricating oils from diesels, motors, turbines and air compressors) and of the methods used to recover the oil. C. C.

621.899

165. Investigational Processes in the Purification of Used Motor Oils. E. Graefe. *Brenn.-Chem.*, 1935, **16**, 326–330.—The significance of the reclamation of used motor oils is illustrated by the experience of the Saxony Power Transport Co., owning 750 vehicles covering daily a distance approximating to the earth's circumference. This concern operates solely on oil reclaimed from its own vehicles or from external sources, and the oil in each vehicle is run for the equivalent of fourteen normal days between each re-purification. By these means a saving of 100,000 Mks. per annum and a considerable reduction in repair costs have been achieved.

All satisfactory reclamation processes effect at least the removal of mechanical impurities. Other deterioration, such as increase of asphalt, is of less importance. The oil is tested for the content of mechanical impurities, for water content and the degree of dilution. The latter infinities may be determined by distillation of a sample to a predetermined temperature using a thermometer with the bulb in the oil.

The proportion of mechanical impurities consisting of carbon and mineral matter may be estimated approximately by visual observation of a drop of the oil either on a glass plate or microscopically. For quantitative estimation, filtration of the original oil or after dilution with a solvent is suitable. The degree of dispersion of the impurities after dilution is dependent on the nature of the diluent, oxygen-containing solvents, such as alcohol and ether, giving better flocculation than hydrocarbons. A mixture of equal parts of benzole, ether and alcohol is recommended.

The insoluble matter may be further examined by the use of a magnet for the removal of particles of iron, the carbon content then estimated by loss of weight on ignition, and metallic constituents subsequently removed by boiling with hydrochloric acid, leaving a final residue of insoluble mineral matter.

The procedure described, although accurate, consumes much time, and for quick estimation use may be made of the stain intensity produced by the oil on filter paper, the principle of which has been communicated by R. John in U.S.P. 1,925,254. The present author proposes dilution of the oil before dropping on to filter paper, and has assembled a small apparatus, including a colour scale, for the convenient and

speedy operation of the test. The accuracy of the test is 0·25% of impurity, and it is recommended that a content of 1·0% should not be exceeded before changing the oil.

B. C. A.

665.521.5

166. Production of Lubricating Oils. E. R. Smoley and W. W. Kraft. *Ind. Eng. Chem.*, 1935, **27**, 1418.—Flow diagrams of typical solvent-refining and solvent-dewaxing processes are given, and the importance of the separation of water from the solvent in the recovery stages is indicated. Water can enter the system with the oil or solvent or through leaks in the condensing and cooling apparatus, and the water content must be controlled if the desired solvent properties are to be maintained. Normally, water will concentrate in the solvent phase and on recovery of the solvent, a certain percentage will be associated with water, resulting in an operating loss. In dewaxing processes, however, water is removed in the form of ice along with the wax. Solvents may be classified into: (*a*) Those not forming constant-boiling mixtures and immiscible with water. These are benzene, toluene, liquid propane and carbon tetrachloride, etc., which may be separated by decantation. (*b*) Those miscible with water and not forming constant-boiling mixtures, *e.g.* acetone and SO_2. Separation in this case is by fractionation with special precautions for water removal. (*c*) Solvents forming constant-boiling mixtures where mutual solubility of the two is small, *e.g.* chlorex, ethylene dichloride, nitrobenzene and trichlorethylene. In these cases, most of the solvent is recovered by distillation, and a small proportion, associated with water passed to a separator. (*d*) Those forming constant-boiling mixtures where mutual solubility of the two is appreciable, *e.g.* aniline, *o*-, *m*- and *p*-cresol, furfural, methyl ethyl ketone and phenol. "Salting out" may be employed in this case.

W. H. T.

665.521.5

167. Design and Operation of Bradford–Penn Chlorex Plant. Anon. *Refiner*, 1935, **14**, 558–561.—This plant, designed for continuous operation and used for the refining of Penna oils, is capable of processing up to 400 brls. of steam-refined stock or up to 600 brls. of neutrals per day. Contacting is by series passage through four columns provided with drilled baffles, the contact time being between one and two minutes. Settling occurs in horizontal drums over a period of about 30 mins. The extraction temperature ranges between 60° and 125° F. and oil/solvent pass counter-currently through the contact system.

The solvent recovery system operates at 80–100 mm. absolute pressure, with indirect heating by heat exchange and hot oil circulation. The heated charges flash to the stripping columns at 300–325° F. Exhaust steam is introduced at the base of both columns to facilitate stripping. Both condensed water and solvent are cooled in a unit common to raffinate and extract recovery systems, and are separated in a barometric column. The water containing about 1% solvent is preheated and flashed to a packed column into which live steam is introduced. The loss of solvent is estimated as 0·04%.

Loss of oil to extract varies from 7 to 10%. The extract solution contains approximately 85% solvent, whilst the raffinate phase contains only about 15% solvent. The V.I. may be raised to near 120 by the normal operation of the unit.

B. C. A.

665.521.5 : 668.3

168. Patents on Lubricants. Sinclair Refining Co. E.P. 437,486, 30.10.35. A dewaxing process in which the oil–wax mixture is diluted with an ethyl ester (b. p. 185–315° F.), the solution chilled and the wax separated.

Texaco Dev. Corpn. E.P. 437,779, 5.11.35. A method for removing wax from oil–wax mixtures, which comprises mixing the latter with a condensation product which modifies wax crystal formation, chilling the mixture and separating the wax. The condensation product may be a tarry residue resulting from high vacuum distillation of a condensation product of naphthalene in the presence of aluminium chloride.

Machin. App. Fabrik. E.P. 437,843, 6.11.35. Separation of asphalt from oil by counter-current extraction with light benzine.

Stand. Oil Dev. Co. E.P. 437,934, 7.11.35. Lubricants are improved by the addition of a viscous or plastic polymerization product (mol. wt. above 800), obtained by treating a fraction of cracked oil (b. p. below 120° F.) with an active halide polymerizing agent at below 100° F. approx.

Planktokoll Chem. Fabrik. E.P. 438,185, 12.11.35. Mineral oils, waxes, etc., are refined by slightly acidifying the substance and then treating with a chemically active dried powder, colloidal mud or slime obtained from salt or fresh water.

Anglo-Iranian Oil Co. E.P. 438,425, 11.11.35. Bloom or green fluorescence is imparted to lubricating oil by the addition of a small proportion of a compound produced by heating pyrene in the presence of anhydrous aluminium chloride

W. H. T.

J. Y. Johnson. E.P. 439,621, 11.12.35. Solvent extraction of lubricating oil by means of a solvent consisting of 75 pts. of acetonitrile and 100 pts. of nitrobenzene.

Coutts & Co. E.P. 439,674, 11.12.35. Solvent extraction of lubricating oils by means of a solvent consisting of 50 pts. of methanol and 50 pts. of nitrobenzene.

W. S. E. C.

Fuel Oil.

662.757 : 608.3

169. Patents on Fuel Oil. A. A. Roberts. E.P. 438,351, 11.11.35. A coal–oil mixture, the dispersing agent being an aqueous solution of a water-soluble boron compound. Combustion stabilizing materials, *e.g.* sodium chloride, are also added.

W. H. T.

Asphalt and Bitumen.

625.85

170. Physico-Chemical Aspects of Asphalt Pavements. C. Mack. *Ind. Eng. Chem.*, 1935, **27**, 1500.—Of the forces acting on the surfaces and at the interface in a system, mineral aggregate–asphalt, interfacial tension is the most important. It is shown that typically hydrophilic solids have energy relations at their interfaces with pure liquids which are of the same order as at the interface between water and the same liquids. The volume to which a lyophilic powder will settle in a pure liquid is proportional to the interfacial tension between the two phases. This forms the basis of a simple method for measuring the interfacial tension between solids and liquids. The method has been applied to six asphalts and three aggregates (silica, limestone and blue clay) and the results have shown that the interfacial tensions between the asphalts and solids vary not only with the type of aggregate, but also with the type of asphalt. Interfacial tension–concentration curves show that above an asphalt concentration of 20% by wt., the interfacial tension of the asphalt has a straight-line relationship with the concentration, this permitting extrapolation of interfacial tension with a high degree of probability. Spreading occurs only if the energy of adhesion is greater than the energy of cohesion of the spreading liquid. Asphalts having a high coefficient of spreading towards an aggregate possess a high degree of wetting for the solid, resulting in a thin film of asphalt, and the tensile strength of an adhesive layer increases as its film thickness decreases. Since the stability and durability of asphalt pavements depend on adhesion forces, it is necessary to determine this force in order to make predictions with regard to the behaviour of asphalt paving mixtures on the road.

W. H. T.

665.45

171. Modern Use of Asphalt. D. M. Wilson. *Bull. Perm. Int. Assoc. Road Cong.*, **24**, 241–246; *Contract J. Suppl.*, May 1935.—Methods for examination of mastic asphalts for detection of source of the constituents are described. Mineral aggregates from different asphalt rocks show different colours when exposed to ultra-violet light, St. Jean rock assuming a pale sandy colour, Sicilian and Val de Travers rocks a darker colour and crystalline limestone a comparatively dark brown. The difference in colour of Seyssel rock and crystalline limestone is more easily judged when using a carbon arc, the rays being concentrated by means of a metallic mirror and the visible

light rays eliminated by the use of "Uviol" glass, Seyssel giving a light reddish-brown colour and the limestone a bright crimson. The combination of minerals obtained as a residue on treatment of the aggregate from rock asphalt with dilute hydrochloric acid is characteristic of each rock. These minerals can be separated, for examination, by stirring with Bromoform, and the minerals which sink to the bottom further separated magnetically. Many limestones contain fluorite, whereas none of the commercial rock asphalts contains this mineral. Useful information can be obtained by microscopic examination of the washed aggregate retained on an 80-mesh sieve, from the grading of the aggregate, bitumen-carrying capacity and colour of the bitumen. A. O.

665.45

172. **Bitumen in Industry.** H. Bösenberg. *Oel und Kohle*, 1936, **12**, 1–3.—A critical review of modern applications of asphaltic bitumen. P. G. H.

665.45

173. **Significance of Bitumen in the German Petroleum Industries.** T. Temme. *Petr. Zeit.*, 23.12.35, **31** (50), 1–6.—This is a descriptive article dealing with the uses of bitumen in German industries, in particular the building of roads, bridges, tunnels and canals, and in the manufacture of roofing paper, paper, rubber, varnish and electric cables. W. S. E. C.

665.521.8

174. **Manufacture, Packaging and Shipping of Oxidized Asphalts.** Art. 9. G. C. J. Holland. *Petr. Eng.*, Oct. 1935, **7** (1), 38.—Four commercially practical methods of mechanically agitating the liquid and vapours within the still of a continuous oxidizing unit are discussed. These are :—

(1) *Turbo Mixer.* Little practical experience is available with this type in ordinary stills, although in general its efficiency is well known. It is possibly, however, too efficient and costly for this purpose. A description with diagram is given of a recommended type of turbo mixer system, of which a smaller unit is stated to be working satisfactorily in a plant in Southern France. The chief advantages claimed for this system are reduced air consumption and reduced cycle time. Air saving is, however, of little financial value, whilst a plentiful air supply has the advantage of removing excess exothermic heat from the reaction zone, thus allowing the reaction to proceed more rapidly. Reduction in cycle time can also be achieved more economically by system (2).

(2) *Outside Pump Recirculating System.* In a Baku plant surplus exothermic heat is removed by a 100 brl./hr. capacity recirculating pump and asphalt cooler. This allows for faster oxygen absorption, at the same time providing mechanical agitation, Air consumption was reduced by one half and cycle time by 300–400%.

(3) *Internal Reflux System.* (See *J.I.P.T.*, 1935, Abstr. No. 1462.)

(4) *Stirring Device.* The paddle-and-chain stirring device as used in Plant No. 1, preferably containing a second and third paddle of more efficient design, is recommended for the Mexican Unit. Alternatively, an automatic whirling shaft and paddle of the ordinary lawn sprayer type might be used.

Further recommendations or details of the proposed equipment are given.

C. L. G.

667.624.17

175. **Air-drying Asphaltum Finishes.** E. Assheton. *Paint Manufacture*, 1935, **5**, 371–373.—Air-drying asphaltum finishes vary largely in their composition from a simple solution of a pitch to a high-grade black japan.

Of the pitches in common use, one of the most important is natural asphalt, which occurs naturally in Trinidad, Judea, Bermuda, Venezuela and Utah, U.S.A. All these differ in hardness, blackness, etc., especially the Gilsonite from Utah.

These natural asphalts often contain dirt, from which they are freed by melting and straining. They require the use of a large amount of rosin to keep them in solution, otherwise a quantity comes out of solution, causing heavy foots.

Other materials used include bitumen from the distillation of petroleum, stearine and cottonseed pitches, coal-tar and bone pitches and artificial pitches.

The simplest type of finish is obtained by making a straight solution of asphaltum in naphtha or xylol. This gives a brilliant surface when applied to metal, but has poor tensile strength, and develops cracks on exposure to sunlight. Moreover, such a film has no resistance against oil, grease and solvent, and it is almost impossible to paint over such a material with ordinary paint or enamel, as the asphaltum will bleed through.

An improvement in flexibility can be obtained by blending the asphaltum with spindle or similar oil.

For making better-quality finishes, the asphaltum must be blended with linseed oil, and often also a certain amount of resin.

Gasoline-proof blacks are made by cooking together a phenol–formaldehyde rosin-modified resin, wood oil and asphaltum.

Black japans are usually high-grade asphaltum varnishes to which have been added some copal varnishes.

A number of representative formulæ are given. The thinners—mainly white spirit—have to be chosen for their solvent power, and Rumanian white spirit, being richer in aromatics than many others, is particularly suitable for these finishes.

D. L. S.

665.45 : 608.3

176. Patents on Asphalt. R. Illeman. E.P. 439,272, 3.12.35. Prevention of sticking of bituminous mixtures. The components are partly mixed and the mixing completed at the place of use. W. H. T.

665.454.43 : 608.3

Deutsche Röhrenwerke. D.R.P. 615,175 (591,539), 18.5.31. Molten bitumen is mixed for coating purposes with crude caoutchouc which has been depolymerized by heating. L. S.

Special Products.

665.521.5 : 621.785.65

177. Examination of Some Quenching Liquids. N. E. Wood. *J.I.P.T.*, 1935, 21, 995–999.—A short account of initial experiments on the comparison of various liquids with respect to their efficiency in quenching steel, and with particular reference to petroleum oils. G. R. N.

661.763 : 608.3

178. Patents on Special Products. P. Burger. E.P. 438,883, 25.11.35. Carbon-black is rendered less dust-like and more suitable for practical working by being passed through rollers, whereby it is formed into thin scale-shaped plates.

W. H. T.

Engines.

621.43 : 621.89

179. Engine Filter System. E. Sterrett. *Oil Weekly*, 25.11.35, **79** (11), 57.—To prevent granular carbon from circulating through the bearings of its internal-combustion engines, one company has experimented with an auxiliary oil-cleaner system, using cotton waste as the filter element.

After a number of trials a 31-inch length of standard 6-inch pipe was selected as the barrel for the filter, and a flexible coupling was formed by means of a tripod. The filter element was formed from a length of 24-inch wide half-inch mesh hardware cloth, and the space formed by winding the cloth into two turns was filled with loosely felted waste.

The whole element was then soaked with oil to ensure flow as soon as it was put in the line.

The cloth cartridges can be changed when desired. L. V. W. C.

621.433

180. Extended Expansion in I.C. Engines. E. Giffen. *Engineer*, 1935, **160**, 626–628.—The object of the investigation carried out by the author was to improve the efficiency of the gas engine and other engines operating on the Otto cycle, so that they would compare more favourably with the high-efficiency oil engine.

The author points out that an extension of the stroke to give a higher expansion ratio, and in consequence greater efficiency, means an increase in the swept volume of the engine or, for a given size, a reduction in the mean effective pressure. Various mechanisms have been introduced in the past to give a longer effective stroke during expansion than during suction, but mechanical difficulties have prevented their adoption.

The cycle of operations suggested by the author involves no radical changes in the engine construction, but only a modification of the arrangements for controlling the charge weight. In this cycle it is stipulated that the compression line on the indicator diagram shall not rise above atmospheric pressure until the piston has moved part way up the compression stroke, but that the final compression pressure shall be unchanged. The effective compression ratio is then less than the expansion ratio. This cycle of operations can be obtained in practice either by early closing of the inlet valve or by throttling the charge into the engine.

From theoretical considerations, the author finds that if in the suggested cycle the expansion is 25% longer than the effective compression stroke, the efficiency is 9% greater than in the ordinary engine, but the mean effective pressure is 20% lower. Owing to the lower mean effective pressure, it would be expected that the mechanical losses would be slightly increased, and, further, if the reduction in the effective compression stroke is obtained by throttling, an additional loss will take place due to increased pumping losses. The whole of the theoretical gain in efficiency will then not be expected in the brake performance.

Tests are described which were carried out on a Crossley gas engine using town's gas. In the first series, the engine was run at different loads and at the highest overall compression ratio, the charge being controlled by throttling during suction. These tests gave results for a series of extended expansion cycles with different effective compression ratios, but with a constant expansion ratio. A second series of tests was carried out to obtain comparative values for the Otto cycle under corresponding conditions, and consisted in testing the engine at full load at three lower values of the overall compression ratio.

An examination of these two series of tests showed that the mean pressure for the extended expansion cycle was lower than for the Otto cycle, but that, contrary to expectations, the efficiency was also lower. The gains due to increased expansion must be more than offset by the increased mechanical and pumping losses.

In order to avoid the increase in pumping losses due to throttling, special cams were made to give earlier closings of the inlet valve. When using these cams with no throttling, considerable reductions in the pumping losses were obtained, and the brake efficiencies were increased above those for the Otto cycle by amounts comparable with the theoretical values. The mean pressure was reduced as was expected.

In designing an engine to work on the suggested cycle, the effective compression ratio would be as large as possible consistent with absence of detonation. The extension of expansion which determines the point at which the inlet valve closes would be chosen so as to give a satisfactory compromise between increased efficiency and reduced mean pressure. Such an engine could be governed either by throttling or by the induction cut-off method, in which latter case a further benefit would be obtained. J. G. W.

Detonation.

621.317.755

181. The Standard Sunbury Engine Indicator. E. S. L. Beale and R. Stansfield. *Engineer*, 1935, **160**, 617–619, 642–644, 667–669.—The Standard Sunbury engine Indicator had its origin in the need for an instrument which could be used for measuring the delay time in an oil engine at the highest of engine speeds. The success of the preliminary apparatus led the authors to develop an instrument which would be applicable to all types of engine, and which would indicate not only pressures, but also movements of various parts of the engine.

Each indicating unit consists of a magnetic member moved by the pressure or other change which it is desired to examine, this movement taking place in the field of a magnet. Around the pole of the magnet is wound a search coil in which is induced an electromotive force proportional to the rate of movement of the magnetic member.

The moving member in the case of pressure-indicating units takes the form of a diaphragm of thickness depending on the range of pressure to be investigated. In the case of movements of valves, etc., the end of the valve itself or a suitable extension can be arranged to give rise to potential changes in the search coil which will be proportional to the rate of movement. It is even possible with the apparatus to indicate the movements of valves which are completely surrounded by metal, provided the valve itself is magnetic and the surrounding metal non-magnetic.

Shaft vibrations and torsional oscillations can also be measured with suitable additional apparatus.

The output from the indicating units is applied to a three-stage amplifier one stage of which can integrate the potential changes from the search coil, which are proportional to the rates of change of pressure or rates of movement, to potential changes, proportional to pressures or movements.

A cathode-ray oscillograph provides the screen on which the diagrams are made visible. The pressures or movements are applied in the vertical direction, and to the horizontal or "X" plates of the cathode-ray oscillograph a time base is applied which is controlled by the engine crankshaft or other rotating part. The scale of the time base can be varied over wide limits, so that either the whole cycle can be examined, or any desired portion, in greater detail. Calibration of the time base is effected by applying to the "Y" plates of the oscillograph, a wave form, generated in a pick-up unit mounted near to the slotted rim of a disc in the time-base control assembly. The pitch of this wave form is a definite number of degrees of rotation.

The amplifier is provided with switches so that any indicating unit can be applied to the oscillograph to give either a velocity or an integrated diagram.

The design of the indicator units and the amplifier is gone into in detail, and such factors as calibration of the units, frequency response of the units, details of the integrating circuit and the characteristics of the complete integrating amplifier are dealt with fully.

Methods of checking the efficiency of the complete apparatus are also described.

A number of typical diagrams obtained with the indicator are given, which include cylinder pressure diagrams, rates of change of pressure diagrams, "weak spring" diagrams, atomizer valve movement and velocity diagrams, fuel-pipe pressure diagrams and movement diagrams of valve lifts. J. G. W.

621.385.83

182. Cathode-ray Tube Focusing Arrangements. R. R. Batcher. *Instruments*, Nov. 1935, **8** (11), 298–303.—The arrangements for focusing the electron beam in gaseous tubes, and the use of electrostatic focusing in highly evacuated tubes are described. The latter involves a brief consideration of electron optics. Magnetic focusing is treated at some length. Finally, various focusing troubles and the means necessary to overcome them are discussed. P. D.

621.385.83 : 621.386.832

183. Fluorescent Screens in Cathode-Ray Tubes. R. R. Batcher. *Instruments*, Dec. 1935, **8** (12), 335–339.—The action of the electron beam in causing fluorescence and phosphorescence is briefly described. A comprehensive list of fluorescent salts and minerals is given. The effects of differences of actinic characteristics and rates of decay, and the use which may be made of the variations in these properties, are considered, and the article is completed by a consideration of the method of depositing screens, both for visual and photographic work, and the erection of calibration scales. P. D.

General.

614.845.6

184. Dry Powder Foam Systems Supplanting Old Wet Installation. Anon. *Nat. Petr. News*, 30.10.35, **27** (44), 29.—The desiderata of the advantages of the dry powder system over the older system in which the foam-producing chemicals were stored in

solution form in fire-fighting equipments are given. Suggestions are made for the conversion of the wet-solution type equipment and for the minimal sizes of storage facilities for the dry-powder system. H. G.

665.5 : 389

185. Measurement of Petroleum. By Weight or Volume? H. Platz. *Bol. Inform. Petroleras* (*B.A.*), Nov. 1935, **12** (135), 65–67.—The pros and cons of the measurement of petroleum by weight or by volume are discussed. It is pointed out that field and refinery measurements are, of necessity, by volume. It is further pointed out that measurement by volume is general as regards most liquids employed in commerce, in spite of the confusion of the various units of volume employed.

The strongest argument for measurement by weight is that the figure obtained is independent of pressure and temperature. Most authorities, with the exception of the German shipping companies "Hapag" and "Lloyd," agree that measurement by volume is the more generally satisfactory. The author repeats the recommendation of the Institution of Petroleum Technologists that this measurement should be made in metric units, reduced to a common temperature and pressure. L. O.

665.5 : 66 (47)

186. Petroleum Industry in the U.S.S.R. I. Ganitzchi. *Mon. Petr. Roum.*, 1935, **36**, 1701–1705.—During this autumn the Caspii–Orsk pipe-line has commenced to operate. This is a 12-inch line of 734 km. between the north shore of the Caspian Sea (the port of Guriew) and the town of Orsk (Bachkiria). The main line is fed by many pick-up lines, and when all pumping stations are completed, will handle about 2½ million tonnes of crude a year. The construction of a railway between Guriew and Orenburg is also described. The region Oural–Emba thus now takes second place to Baku–Grosny as a petroleum centre in the Soviet. The Dossor field has, during 1935, slightly exceeded the five-year plan estimates, and the Emba trust in 1936 is expected to produce about 1,000,000 tonnes of crude. The author next describes drilling activity before and since the régime of the U.S.S.R. From 1821 to 1920 about 264 million tonnes of oil were produced in the U.S.S.R., whilst from 1920 to 1934, about 70% of this figure was attained. In 1934, for example, 24,205,000 tonnes were produced, and 1935 figures are expected to indicate further increases. The latter are due to increased prospecting and development of new fields, discovery of new horizons and better drilling methods. These claims are supported by figures. The rotary system of drilling is now almost universal. The number of metres drilled from 1923 to 1935 are given, the estimated 1935 figure being 1,600,000 metres.

W. E. J. B.

665.5 : 66 (82)

187. The Industrialization of Petroleum in the Argentine Republic. E. P. Cánepa. *Bol. Inform. Petroleras* (*B.A.*), Nov. 1935, **12** (135), 1–48.—An account of the evolution of the industrialization of petroleum, with particular reference to the progress already made and still requisite in the Argentine.

The necessity for the industrial treatment of every known type of crude petroleum, before it can have any general commercial application, is pointed out. This is followed by an historical summary of the development of distillation technique in U.S.A., Europe and Argentina, which includes notes on cracking processes and the use of anti-detonants and anti-oxidants.

The first State-controlled refinery was put into operation at Comodoro Rivadavia in May, 1914, and had a capacity of 350 cu. m. a day. The gasoline and kerosine fractions alone were separated, leaving a residue of fuel oil, amounting to 87%.

At the end of 1925 a State refinery, which included two Cross cracking plants, was opened at La Plata. Up to that time a total of 4,187,863 cu. m. of crude petroleum had been produced, of which only 25% had been treated in any way, the remainder having been burnt directly instead of coal or used in a few diesel motors. The La Plata refinery produced gasoline, kerosine and fuel oil only in 1926. To these products Agricol (kerosine for tractors) was added in 1927, diesel oil in 1928, and tractor gas oil in 1929. A third Cross unit was added to the plant in 1928 and a second straight distillation unit in 1931. A plant for gas liquefication was put into operation at the

end of 1932 for the production of "Supergas," and a fourth Cross unit has now been added to the refinery. In all, 32 million pesos have been expended at La Plata. The refinery is now capable of handling 3000 cu. m. of crude oil per day.

In various parts of Argentina there are also two small State refineries, and fifteen privately-owned plants of varying age and capacity, in operation. The total daily capacity of the eighteen refineries is 10,310 cu. m. Thus, allowing for 300 working days, the annual total refinery capacity is over 3 million cu. m., or about 35% in excess of the domestic crude-oil production for 1934.

Further increases in refinery capacity should not be made without establishing the necessity. Witness U.S.A., where, in 1934, there were 628 refineries with a total daily capacity of 670,000 cu. m.; of these 145, with a capacity of 71,000 cu. m., were shut down, and 483 were working to 65% of capacity. The economic repercussions of such a state of affairs is obvious.

The Argentine, in 1936, hopes to eliminate the importation of all petroleum products, with the exception of 800,000 cu. m. of fuel oil. The next great advance should be the utilization of the vast resources, now largely wasted, of natural gas. This subject is dealt with at considerable length in the article.

Lines of improvement in nationally-produced motor spirit, alcohol mixtures, and diesel oil are indicated.

The paper is illustrated by nine photographs, five diagrams and two tables.

L. O.

665.5 : 66(82)

188. The Petroleum Business. E. S. Bilbao. *Bol. Inform. Petroleras* (*B.A.*), Oct. 1935, **12** (134), 1–26.—A plea, in excellent rhetoric, for the State control of every branch of the petroleum industry, and a critical exposition of the wastefulness and high cost of unregulated competition by private interests, particularly as it has affected the Argentine.

The article opens with an account of the uses of petroleum products and of the history of their development. The complete paralysis of all mechanism and the destruction of the progress of a century—should the supply of oil be interrupted—is visualized. Petroleum has become a public necessity of prime importance and, as such, it should be subject to State control, just as are other public utilities.

The Argentine republic now produces sufficient gasoline for its immediate domestic needs, and even for defence in case of war, but fuel-oil requirements cannot be supplied from internal sources. Continuous exploratory work is necessary, therefore, to overcome this shortage, and to balance the inevitable decline of production in existing wells.

Governmental regulations have reduced the bad effect of wasteful competition between distributors: the price has been stabilized, lowered, and made uniform throughout the republic. In 1920, the price of gasoline was 35 centavos per litre; in 1930, 20 centavos: to-day, the basic price (less road tax) is 18 centavos, which compares very favourably with that ruling in other parts of South America.

An attempt by private distributors in October 1931 to increase the price of gasoline by 4 centavos, on account of a rise in foreign currency, was defeated by firm action. Other notable effects of regulation have been the creation of a new petrol industry in the country, the building of many local refineries, and the checking of the export of capital.

Excessive distribution costs, due to a multiplicity of distributors, bear heavily on the industry, and, of necessity, fall ultimately on the commonweal and the consumer. These costs are aggravated by competitive selling. Certain towns in U.S.A., not very long ago, had a service station to every five motor-cars. In Buenos Aires, where there were 54,420 motor-cars registered (to May 31st, 1935), the number of gasoline pumps was 4541, or one to every twelve vehicles! Similar conditions exist in many of the provincial towns, and should be eliminated to the benefit of all concerned.

Five diagrams are included in the article. They deal respectively with Petroleum By-products; Operations Entailed in Bringing Gasoline to the Consumer; Petroleum Storage Plant at San Lorenzo; Sales Organization; and Actual and Regulated Systems of Distribution.

The article ends with a résumé of the regulations imposed on the petroleum industry in countries other than the Argentine.

L. O.

REVIEWS AND BOOKS RECEIVED.

Reviews.

562/569 : 551.78(02)

TERTIARY FAUNAS. By A. Morley Davies, D.Sc., A.R.C.S., F.G.S., Hon. F.R.G.S. Vol. I: THE COMPOSITION OF TERTIARY FAUNAS. London: Thomas Murby & Co., 1935. Pp. xi + 406. 22*s.* 6*d.* net.

THE necessity for a comprehensive text-book on Tertiary palæontology in English has long been recognized, and the lack of such a publication has been felt—probably more acutely than anywhere else—among oil geologists. This is not surprising when it is realized that more than one-half of the world's present production of crude petroleum comes from deposits of Tertiary age, and that, outside U.S.A., more than 90% of to-day's oil is produced from Tertiary beds.

Vol. II of this work, which dealt with the Sequence of Tertiary Faunas, has already (Vol. XX, 1934) been reviewed in this *Journal*. Vol. I, now published, gives systematic descriptions of Tertiary genera the geographic distribution and interrelation of which were analysed in Vol. II.

The volume under review is illustrated by 891 line drawings, 865 of which are grouped on fifty-three plates, the remainder being incorporated in the text. There are also five diagrams dealing with evolution and classification.

The drawings are a model of economy of line and of clarity, and all users of this book will owe a debt of gratitude to Mrs. Davies for the craftsmanship and artistry with which she has redrawn her husband's sketches. She has had, of course, excellent material to work upon, as anyone who has witnessed Dr. Davies' blackboard demonstrations will know, but it is extremely fortunate for posterity that the preparation of these permanent records of his skill has been in such competent hands, not omitting the part played by publisher and printer. Speaking as a bush-geologist, the reviewer would like to see the fifty-three plates issued as a separate volume, so that they could be carried in the field.

The selection of the most satisfactory generic names—out of the *olla podrida* of past and present alternatives—is always a difficult matter, but few can quarrel with the author's method of relegating what he considers the less correct into "concentration camps," even if some of the internees "may be set free and proclaimed as the long lost heir."

Foraminifera take up sixty-three pages, and geologists, except perhaps those of very recent vintage, will be thankful that Brady's classification (with certain modifications) has been retained. Echinoidea are dealt with in fifty-two pages, lamellibranchia in ninety-three, gastropoda in fifty-one, and other invertebrata in ten, whilst vertebrata occupy fifteen pages.

Ample glossaries and bibliographies are attached to each section. The book ends with a systematic index, followed by a general index. The latter might advantageously be extended in future editions, but there can be no doubt that this work, as it stands, will receive an enthusiastic welcome from all those who have to apply palæontology in oil-field practice and from students of Tertiary geology in general.

LAUNCELOT OWEN.

625.8.07(02)

ROAD AGGREGATES: THEIR USES AND TESTING. By Bernard H. Knight. Pp. x + 264. 112 figs. 1935, Edward Arnold & Co., London. 21*s.* net.

This work is a praiseworthy attempt to give the "road man," in as concise a form as possible, a reference book dealing in a scientific manner with the all-important problem of selecting the most suitable aggregates for his highway.

While engineers and chemists have written much during recent years in their respective spheres, the selection of the most suitable road aggregates is unquestionably, in large part, work for the geologist in collaboration with the engineer, and a treatise dealing specifically with road stones and produced by a geologist and engineer was badly needed.

The general style in which this volume has been written is excellent, and for a first

edition the work is remarkably free from minor errors. While taking full advantage of the application of pure geology to the problem, the author has not rendered the book difficult or incomprehensible to those with only a limited knowledge of geology.

The misuse of such names as granite and basalt by those handling road materials in this country is lamentable, and Dr. Knight's plea for classification on something more nearly approaching true petrological nomenclature is long overdue. While all in authority who handle road stones may not be in a position to have sections cut for petrological examination, surely every quarry owner should at least be able to state the correct geological classification of his own product.

The interpretation of the common physical tests described under Chapter V is difficult. At the end of the chapter a short table is given to facilitate comparisons. Unfortunately, the author has included only five rocks therein—four igneous rocks and one of metamorphic origin. This table might usefully be extended to include a much wider range of well-known road stones, including sedimentary rocks such as limestones and gravels, although Chapter VII does give the results of attrition tests for different types of stones, and the author makes it clear that "physical tests considered by themselves often form misleading data as to the suitability of rocks for road-making."

Chapter VI includes a brief survey of recent work on the subject of adhesive properties of aggregates and asphaltic bitumen or tar. Since, as pointed out by the author, this problem is still very little understood, and since the tests are not as yet generally accepted, most laboratories will doubtless feel that any results obtained must for the time being be judged with great caution.

While Dr. Knight deals at considerable length with the selection of aggregates for concrete work, the relative suitability of granites, limestones, gravels, etc., for different types of bituminous construction has received but scant attention. Slag is regarded as unsuitable for use as chippings, while the sedimentary rocks of this country are stated to be definitely inferior to the igneous rocks for use as macadam and chippings. This may frequently be the case, but is it not a fact that there are many miles of roads made up with these "soft" aggregates which are standing up with every satisfaction to really heavy traffic?

The author will doubtless be considered by many to be unduly severe in his criticism of sedimentary rocks and slags. The following quotations from the work serve to illustrate this: "The sedimentary rocks are, however, suitable for use on roads in which the traffic is sufficiently light, such as estate roads and unclassified roads."—"The only suitable sedimentary material of later age are the flints and chert occurring as nodular masses in chalk and limestone. These materials have considerable local use on unclassified roads in those parts of the country which are unfortunate in being at some considerable distance from good roadstone quarries. . . ."

The general conclusion after reading this book is that it makes an excellent starting point towards the evaluation of road aggregates from both the scientific and the practical viewpoints, and that there is an enormous field to be explored by the application of petrology carefully correlated with practical results. Whether chippings for surface dressing must have a minimum crushing strength of 25,000 lb. per square inch, or whether slag which emits a perceptible odour when struck with a hammer must be rejected as useless for road work, are points which, among others, will doubtless receive further consideration by road laboratories. CHAS. F. JACKSON.

621.43 (02)

DIESEL AND OTHER INTERNAL-COMBUSTION ENGINES. Howard E. Degler. 237 pp., 100 figs. 2nd Edn., 1935, American Technical Society, Chicago. $2.50.

The first edition of this book was published under the title "Internal-Combustion Engines," but because of the increasing importance and wider application of the diesel engine, the more descriptive title of the present work has been used for this second edition.

The sub-title of the book is "A Practical Text on the Development, Principles of Operation, Construction, Details and Performance of Stationary and Portable Diesel, Gas and Gasoline Engines." Obviously any attempt to cover such wide and diverse ground must result in a treatment of the subject which remains only general. The degree to which such a treatment is valuable depends on the viewpoint of the author

as to the class of reader to whom his observations and opinions are addressed. After reading the book, one is left with the impression that it is designed to meet the needs of the technical and university student. To meet the needs of designers and technicians a more thorough revision of the original material would be necessary, and some of the subject-matter would require to be re-written.

After a short introductory chapter, the principles of thermodynamics are discussed, followed by a section on fuels and fuel–air mixtures. The succeeding chapters deal with gas and gasoline engines, vaporizing oil engines, heavy-duty diesels, high-speed diesels, diesel fuel-injection, engine parts, and testing and performance, and the book concludes with a short section on the economics of diesel power.

J. L. Chaloner.

665.54(02)

Theorie und Technik des Crackens. R. Fussteig. Pp. 62. 1935, Allgemeiner Industrie-Verlag G.m.b.H., Berlin-Lichterfelde. RM. 6.80.

German scientific and industrial literature has set such a high standard in monographs that it is disappointing to have to record that the little volume now under review is distinctly weak. This is more the pity because a short, illuminating and authoritative summary of this fascinating subject, in whatever language, would have met an undoubted want.

The framework of the book is good enough, one half being devoted to the theory of cracking and the other to its practice; the sections are well chosen and, taking them all in all, balanced in size; but the choice and treatment of the subject-matter leave much to be desired. The book gives the impression of having been written at third or fourth hand, as indeed appears from many of the references. To have, within the first few pages, work of Bone and Coward referred to "*Fuel and Oil*, 1930," of Ipatieff to "*Chem. Abstr.* 1912" and of Levis (sic) (*i.e.* Vivian Lewes) to "*Petrol. Wld.* 1913" shows the standard of execution.

Sachanen and Tilicheyev are freely quoted from, and such excerpts, together with the description of the Dubbs process, which we suspect emanated originally from Dr. Egloff, are amongst the best parts of the volume. The author has not always been so wise in his choice of material, as witness as much space being given to a process for cracking by means of metallic mercury as to the Cross process. Vapour-phase cracking is dismissed almost with a bow, and there is no mention of pyrolysis of gases or re-forming. Both in the theoretical and the practical parts the short sections on hydrogenation read interestingly, but taking it altogether, the reviewer does not consider the monograph would be creditable were it presented as a student's essay.

S. J. M. Auld.

03 : 6

Hutchinson's Technical and Scientific Encyclopædia. Vols. II, III, and IV. Edited by C. F. Tweney and I. P. Shirshov. 1935, Hutchinson & Co., London. Separate vols. 28*s.* each. Complete set of 4 vols., £5.

The first volume of this work was reviewed in the April, 1935, number of the *Journal*, at which period a total of three volumes was foreshadowed as representing the ultimate size of the work.

Subsequently the publishers found it necessary to add a fourth volume in order to cover the ground, and although this increases somewhat the shelf space required to accommodate it, the complete work still justifies the previously expressed opinion that it constitutes a very valuable addition to technological literature, in that it brings together within the scope of only 2468 pages a really astounding collection of useful technical data.

Considerable space is devoted to electrical matters throughout the work, and to those not specially interested in this branch of technology it might appear that the proportion is unduly high. Nevertheless, a study of the many articles and paragraphs dealing with that subject soon convinces the reader that electricity plays too large a part in modern arts and industries to be considered as an entirely separate subject.

The subject of Petroleum is dealt with in Volume IV, about two and a half pages being occupied by a very general survey of the subject.

Apart from this, a survey of the four volumes leaves the impression that petroleum technology has been somewhat neglected: little or no reference is made to the special terms or items of equipment commonly used in the drilling, production or refining sides of the industry, whilst few of the standard methods of testing are available to the reader, even by name. In this respect petroleum technology suffers by comparison with less recondite subjects, such as plumbing or carpentry. If the reader seeks information relating to the numerous types of valve, he will be greatly disappointed to be presented with a four-line definition and cross-references to Hydrants, Sprinklers and Gas Regulators, whilst of Storage Tanks, be they of Breather, Pontoon, floating roof or Hortonspheric types, no word is said.

The subject of welding is of great interest to petroleum engineers, and the last volume gives an excellent three-page general description of available methods.

A very valuable adjunct to the work is the bibliography which appears at the end of Volume IV. This is classified in alphabetical order and takes up thirty-six pages. It provides a list of books and other sources of information, with the date of publication and purchase price, and each item embodies a reference to the list of publishers which is appended.

Taken as a whole, the work can be very highly recommended, and fully justifies the claim made by its publishers that it is the only work of the kind published for a quarter of a century.

J. McConnell Sanders.

Books Received.

Argentina. Department of Mines and Geology, Ministry of Agriculture:

55(82)

Bulletin No. 40. Pilcomayo-Contribucion al conocimiento de las llanuras argentinas. Augusto Tapia. 124 pp., 13 pl., 3 maps and 27 sections. 1935.

553.45 : 55(82)

Publication No. 110. Nos Yacimientos aluvionales de estano del Departamento de Rinconada, Provincia de Jujuy. Pascual Sgrosso. 28 pp., 8 pl., 6 graphs and 1 map. 1935.

55(82)

Publication No. 108. Catalogo de Mapas, Planos y Croquis de la Republica Argentina. Pt. I. Provincia de Buenos Aires y Zona Limitrofe. Roberto Pusch. 120 pp. 1935.

31 : 622.323 622.323 : 622(82)

Publication No. 109. Estadistica de Petroleo de la Republica Argentina correspondiente al año 1934. 40 pp. 41 tables, 3 maps. 1935.

British Standards Institution:

625.85.063

B.S.S. 434–1935. Asphaltic Bitumen Road Emulsion for Penetration (Grouting and Semi-grouting) and Surface Dressing. 31 pp. 1935, B.S.I., London. 2*s*. net.

Experience of the practical application of this specification, which was first issued in 1931, has resulted in suggestions being made for the tightening up of its requirements. Various modifications are incorporated in the new specification, and a new test—the Lability Test—is included which enables the type of emulsion to be distinguished as regards its rate of breaking on the road.

Canada Dept. of Mines:

553.55 : 553(71)

Bull. 755. Limestones of Canada. Pt. III. Quebec. M. F. Goudge. 274 pp., 36 pl., 13 figs., 2 maps. 1935, King's Printer, Ottawa. 50 cents.

666.7 : 620.1

BULL. 766. LABORATORY TESTS ON STRUCTURAL ASSEMBLIES OF BRICK AND TILE. L. P. Collin. 33 pp., 2 pl., 1 fig. 1935, King's Printer, Ottawa. 10 cents.

553.982 : 55(861)

COLOMBIA. INTERVENTORIA NACIONAL DE PETROLEOS. INFORME PRESENTADO AL CONGRESO DE 1935. Sady Gonzalez Bernal. 95 pp. 1935, Bogota, Imprenta Nacional.

662.742 662.941.2

Junior Institution of Engineers. JOURNAL AND RECORD OF TRANSACTIONS. Vol. XLV. 1934–35. 528 pp.

Included in the papers read before the Institution or its Sections are, "Low Temperature Carbonization," by H. G. Wice, and "Practical Fuel Oil Burning with Automatic Burners as Applied to Heating," by P. C. Griffiths.

665.5 : 518

MOORE, HAROLD. PETROLEUM CHARTS AND TABLES. 54 pp. 1935, Moore and George, Ltd., London. £2 2*s*.

A series of charts and tables, bound in loose-leaf form. The charts included are for Viscosity–Temperature curves, an alignment chart for Viscosity Index, a Blending Chart, a chart for Recording Tests on a Two-Component Blend, a Specific Gravity Blending Chart, a Conversion Chart for Shillings per Ton to Pence per Gallon, a Temperature Conversion Chart, a chart for estimating the Capacity of Cylindrical Vessels, a chart showing Theoretical Composition of Exhaust Gases, and a Conversion Chart for Imperial and Metric Linear Units. The charts are approximately 4½ in. × 7 in. in size, and a number of blank charts are included so that data may be recorded for future reference.

The tables cover viscosity conversions and the inter-relationships of Imperial, American and Metric units of measurement.

622.245.333 : 614.777

SCHMIDT, L., and WILHELM, C. J. CONTAMINATION OF DOMESTIC WATER SUPPLIES BY INADEQUATE PLUGGING METHODS OR FAULTY CASING. 15 pp. 1935, Kansas State Board of Health.

The Kansas State Board of Health, in co-operation with the U.S. Bureau of Mines, has been studying the problems of the contamination of fresh-water supplies by brines from oil or gas wells. The report is confined to a brief discussion of the subject and methods are indicated which should reduce the contamination.

665.5 : 518

SCHWARZ, ROBERT. PETROLEUM VADEMECUM. 2 vols. xvi + 330 and viii + 490 pp. 11th edn. 1936, Verlag für Fachliteratur, Berlin and Vienna. 24 marks; 50 öst Schilling; $10.00.

Volume I contains comparative tables for use in the petroleum industry, including English, U.S.A. and metric measures, specific gravity, viscosity, together with tables of properties of various products. The statistical section starts in Vol. I and continues through Vol. II. Details are given regarding production, refining, imports and exports in various countries.

U.S. Bureau of Mines:

622.54 : 614.777

REPORT OF INVESTIGATIONS 3297. PRELIMINARY REPORT ON THE DISPOSAL OF OIL-FIELD BRINES IN THE RITZ-CANTON OIL-FIELD, MCPHERSON COUNTY, KANS. C. J. Wilhelm and L. Schmidt. 20 pp. Dec. 1935.

In making a study of the brine-disposal problem, the Ritz-Canton field was selected as typical of the fields in the vicinity of McPherson, Kansas. The efficiency of existing disposal methods in preventing mineralization of fresh-water-bearing formations and surface streams was investigated, and the report recommends various methods by which this mineralization can be eliminated or reduced.

U.S. Bureau of Standards:

547.214 : 536.662

RESEARCH PAPER RP 833. HEAT OF COMBUSTION OF *iso*BUTANE. F. D. Rossini. 5 pp. 1935, Superintendent of Documents, Washington, D.C. 5 cents.

A report on the calorimetric determination of the heat of combustion of *iso*butane.

U.S. Geological Survey:

55(788)

PROFESSIONAL PAPER 178. GEOLOGY AND ORE DEPOSITS OF THE MONTEZUMA QUADRANGLE, COLORADO. T. S. Lovering. 119 pp., 40 pl., 30 figs. 1935, Superintendent of Documents, Washington, D.C. $1.25.

ABSTRACTS.

	PAGE		PAGE
Geology	72 A	Polymerization	97 A
Geophysics	75 A	Synthesis	98 A
Drilling	77 A	Motor Fuels	98 A
Production	79 A	Lubricants and Lubrication ...	102 A
Pipe-Lines	83 A	Fuel Oil	105 A
Gas	84 A	Asphalt and Bitumen	105 A
Crude Petroleum	85 A	Wax...	107 A
Chemistry of Petroleum	86 A	Special Products	108 A
Analysis and Testing	88 A	Detonation	109 A
Refining and Refinery Plant ...	93 A	Engines	110 A
Cracking	95 A	General	111 A
Hydrogenation	96 A	Reviews and Books Received ...	113 A

AUTHOR INDEX.

The numbers refer to the Abstract Number.

Afanasiev, B. N., 362
Ainslee, W., 297
Albright, J. C., 211, 213, 214, 215, 217
Alexanian, C. L., 269
Anthony, C. G., 317

Bagirov, K., 311
Bailey, D. P., 276
Baker, W. L., 199
Baldeschwieler, E. L., 264
Barr, G., 250
Barret, W. M., 201
Baskin, C. M., 306
Beale, E. S. L., 254
Belchetz, L., 235
Benedict, W. L., 265
Bennett, H. T., 296
Berlin, R. I., 312
Bignell, L. G. E., 195, 207
Bissell, W. T., 296
Black, J. C., 290
Bocharova, E. M., 284
Bosenberg, —, 301
Bost, R. W., 242
Botset, H. G., 189
Bradley, G. W. J., 290
Briand, M., 316
British Thomson-Houston Co., 315
Broom, W. E. J., 251, 252
Buddine, N. T., 272
Buerger, C. B., 276
Byudov, A., 283

Carlson, C. G., 196
Chaney, L. V., 290
Coberly, C. J., 210
Collins, J. F., 248
Conine, R. C., 219
Cooke, M. B., 282

Davis, R. F., 290
Dengler, F. S., 306
Dijck, W. van, 296
Dintzes, A. I., 275
Docksey, P., 254
Dolgov, B. N., 284
Dowzard, E., 257
Drake, N. L., 245
Dubbs, C. P., 276

Egloff, G., 265, 276
Endres, A. F., 290
Eru, I. I., 277
Esbevskaya, M. P., 275
Evans, J., 224

Felder, D. H., 306
Fields, J. D., 296
Fitzsimons, O., 256
Florez, L. de, 276
Frantzus, E., 283
Fusstieg, R., 303

Ganitschi, I., 320, 321, 322
Gardner, E. W., 306
Garner, F. H., 251
Getzen, V. B., 232
Gheorghiu, M., 293
Golyer, B. de, 203
Gomory, W. L., 296
Grace, H. E., 209
Groote, M. de, 234
Grosse, A. V., 237

Hammer, O., 209
Haringhuizen, P. J., 291
Harris, J. Mc. A., 296
Headington, C. E., 295
Hedley, J. B., 194
Heinze, R., 286
Henderson, L. M., 296
Herrmann, P., 300
Holland, C. J., 205
Holzman, E., 267
Hontcharenko, I., 190
Hoover, G. R., 306
Hughes, J. D., 208

Ihrig, H. K., 216, 227, 228
Ipatieff, V. N., 237
Isom, E. W., 276
Ivanov, I. Z., 247
Ivanov, K. I., 246

Johnson, J. Y., 315
Johnson, R. E., 206
Jones, D. G., 289

Keith, P. C., 274
Kemp, L. C., 248
Kersanov, A. V., 288
Khadzhinov, V. N., 244
Kharasch, M. S., 239
King, H. H., 230
Kirner, W. R., 263
Klabina, T. I., 275
Knowles, E. C., 304
Kublo, Y. A., 308
Kuhn, W. E., 248
Kurtz, S. S., 295
Kuznetzova, A. N., 312
Kwal, B., 278

Lerch, W. B., 222
Levin, H., 296
Levine, M., 276
Limburg, H., 296

McCarty, B. Y., 296
McConnell, T. A., 255
McNab, J. G., 239
McNab, M. C., 239
Malisoff, W. M., 259
Mallison, H., 299
Matthews, R. R., 294
Mead, B., 290
Mekler, L. A., 276
Mendius, W., 297
Meyer, G., 260
Mills, B., 191, 204, 212, 221
Moisenko, V. M., 279
Morgan, M. D., 264
Morrell, J. C., 265
Moyer, R. P., 296

Nicholson, F., 242

Ogg, R. A., 240
Olsen, N. S., 276
Orlov, N. A., 247

Palkin, S., 249
Peterman, L. S., 206
Petty, E., 296
Polykova, I. M., 232
Postovskii, I. V., 232
Potter, T. W., 296
Prokhorova, Z. M., 284
Prokopetz, E. I., 244, 277
Pummill, E. T., 274

Ralph, R. G., 223
Rapoport, I., 283
Ravikovich, A. M., 266, 308
Reed, D. W., 189
Rideal, E. K., 235
Roberts, C. H. M., 234
Robinson, J. F., 209
Roduta, F. L., 243
Rodzaevskaya, —, 310
Rossini, F. D., 236
Rudenko, V. V., 287
Russo, M. J., 257
Rutherford, J. T., 290
Ryland, L. B., 261

Savinova, V. K., 246
Sawdon, W. A., 220
Schaphorst, W. F., 268, 271
Schlesman, C. H., 297
Schmidt, W., 302
Schneider, H. F., 255
Schulze, W. A., 290
Seguy, J. D., 276
Sellards, E. H., 198
Shefstead, G. O., 276
Shevyakova, L., 283
Shile, V. N., 266
Shtraler, F. E., 279
Slobodin, V. M., 280
Slooff, A., 260
Slottman, G. V., 231
Smith, L. I., 241
Snarskii, A., 200
Snow, H. R., 276
Stehr, C. N., 234
Stephens, H. N., 243
Storch, H. H., 238
Stratford, W. M., 290
Suknarowski, S., 267
Suslina, V. N., 288
Swan, A., 318
Swanson, H. R., 282
Swerissen, H. T., 306
Swindell, F., 196

Tamele, M. W., 261
Tarasov, B. K., 287
Taylor, F. B., 205
Taylor, F. L., 241
Taylor, J. F. M., 290
Taylor, J. L., 251
Teas, L. P., 193
Thomas, C. R., 197
Thompson, J. W., 226
Thurston, R. R., 304
Tokmanov, —, 310
Tregubov, A. N., 258
Troeller, W. J., 264
Trow, R. F., 276
Turner, B. H., 273

Ubbelohde, L., 253

Veitch, F. P., 245
Vlodrop, C. von, 281
Voorhees, V., 285
Voronov, A. I., 308

Wagner, C. R., 282
Walther, H., 314
Wan, D. A., 291
Waterman, H. I., 281
Weber, G., 218
Whiteley, J. M., 286
Williams, N., 192, 229, 270
Williams, P., 296
Williams, V., 309
Wilson, R. E., 296

Zeiber, B., 295
Zublin, J. A., 209

Geology.

539.411 : 552.513

189. Experiment on Compressibility of Sand. H. G. Botset and D. W. Reed. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1053.—An experiment is described in which the compressibility of a 30–40 mesh sand was measured at pressures up to 3000 lb./square inch. There was only a 2% change in pore value between no load and full load. Since the sand used in the experiment was unconsolidated, the compressibility of even a slightly consolidated sand should be much less, and it is apparent that compressibility of a sand is, in general, a minor factor in oil production, and that compaction effects in the sand are of much less importance than cementation in displacing the connate water, since cementation may reduce the porosity from 36% to 5%.

Tables of porosity before and after compression and charts of pressure are included.

B. F. N. M.

553.982 : 553(443.83)

190. Detecting Oil Horizons at Pechelbronn. I. Hontcharenko. *Oil Weekly*, 20.1.36, **80** (6), 17–18.—At Pechelbronn the producing horizons are shallow, lenticular and much faulted. The normal rock pressure is less than that of the column of mud in the well. Hence it is a matter of some difficulty to know when the productive horizon has been penetrated. Bailing of the mud is often necessary to initiate oil flow, but it does not give the exact position and thickness of the oil-sand.

There is a lag in the appearance of the iridescent oil film on the mud, due to the oil being adsorbed by the clay particles. Light oil is more readily adsorbed than heavy, and the colloidity of the mud increases the adsorption. The film is frequently difficult to observe. Gas bubbles rising through the mud indicate the probable penetration of an oil-sand.

Cuttings obtained from the circulating mud, as well as from the bit and bailer, are of value. Allowances must be made for the time necessary for a cutting to reach the surface, and the appearance of new types of cuttings is most important. The oil in cuttings may be masked by mud, and detectable only under the microscope. To decrease the time in which mud may act to mask the oil in cuttings, drilling is carried out with reversed circulation, cuttings being carried up inside the drill-pipe. Samples obtained thus often give better data than cores.

The evidence obtained in these ways is considered as a whole and compared with that obtained by electrical coring.

G. D. H.

553.982 : 553(76)

191. Deep Possibilities of Gulf Coast. B. Mills. *Oil Weekly*, 20.1.36, **80** (6), 19–22.—The possibilities of finding oil at depths of 8000–10,000 ft. on the Texas–Louisiana Gulf coast are very good. The likely places are deeper and untested formations round known salt domes, and formations above deep-seated domes. The tops of domes have been found in formations ranging from Recent to Eocene.

The Tertiary beds thicken rapidly and dip towards the coast-line. Hence the dip increases with depth. Drilling near Galveston and Houston indicates that the Tertiary and upper Cretaceous beds are 19,000 ft. thick a short distance from the coast. Between Houston and New Orleans wells have shown the beds to thicken eastwards to give a maximum in the Mississippi delta area. South of New Orleans the Miocene is not expected above 10,000 ft., and the basement is placed at 31,000 ft. in the lower Mississippi delta area.

Seismic work points to a basement series at depths of 20,000 ft. in the Galveston area, and along the coastal strip the torsion balance indicates the base of the salt core of various domes to be at 18,000–20,000 ft.

The basin is more pronounced in south-east Louisiana than in south-east Texas, and the bottom of the geosyncline is probably near the present coast-line.

The Claiborne of the Eocene is probably deeper than 15,000 ft. along the coast south of Houston, and it is reasonable to assume the presence of the Wilcox and Midway. In Iberia Parish the base of the salt plugs is placed at 25,000 ft. in the lower Comanche.

The Frio of the Oligocene is the objective of those seeking production around 9000 ft. on deep-seated domes. It seems very favourable in fields such as Iowa and

Roanoke. The fact that the upper Miocene is productive in Terrebonne Parish raises hopes for the Miocene and Oligocene on suitable uplifts. Similar views are held concerning the Cockfield and upper and lower Saline Bayou of the Eocene. An abandoned wild-cat in eastern Wharton county, Texas, found a little oil in the Cook Mountain formation.

In the centre of the geosyncline there will probably be additional beds. The estimated normal thicknesses of formations from Recent to lower Cretaceous, along the coast near Galveston, Texas, are given. G. D. H.

553.982 : 553(763)

192. Producer in Arcadia Parish, Louisiana, Thought Forerunner of New Fields. N. Williams. *Oil & Gas J.*, 16.1.36, **34** (35), 17–18.—A recent gas well drilled about 15 miles N.E. of Tepetate promises a new field in this area.

Geophysical work has led to the belief that a deeply buried salt ridge or anticline exists which extends across northern Arcadia Parish into southern St. Landry Parish. If this is so, production may be expected on local highs such as Church Point, Elton and Richey. Tepetate has already been proved, and gives production at 8300 ft. from a sand believed to be the Frio. J. A. G.

553.982 : 553(764)

193. New Hardin Field, Liberty County, Texas. L. P. Teas. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1389.—A well has been completed at a depth of 7690 ft. and is yielding 279 brl. of oil per day on a ¼-in. choke. It is producing from a sand series in the Yegua formation of the Claiborne Series.

The Gulf Producing Co. was attracted to this area by favourable pendulum results, while others found favourable torsion balance data. The results of reflection seismograph work were indefinite. B. F. N. M.

553.982 : 553(764)

194. Placedo Oil-field, Victoria County, Texas. J. D. Hedley. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1693.—In April 1935 the discovery well at Placedo was completed, flowing 34·6° gravity oil from a depth of 6005–6019 ft. (1000 ft. below top of the Frio formation). Initial production 240 brl. on a small choke.

Soon after, another well, 1 mile south of the discovery well, flowed a small quantity of 24·5° gravity at a depth of 4757–4789 ft. Other operators later obtained several flowing wells from this horizon.

Another test well, 4000 ft. S.E. of the discovery well, developed gas production from 5273 to 5335 ft., making the third producing sand for the Placedo field.

In October 1934 K. D. Owen mapped a large subsurface "high" with apex about 1 mile south of Placedo. In February 1935 the Felmont Corporation began a reflection seismograph survey of the area to check Owen's subsurface structure. The completion of the seismograph work resulted in finding a structure which closely resembled Owen's subsurface structure.

Although the Placedo field is in a very early stage of development, it is possible, on the subsurface and geophysical information, it may compare in size with the Greta oil-field. B. F. N. M.

553.982 : 553(766)

195. McAlester Basin, South-east Oklahoma, Contains Many Possible Structures. L. G. E. Bignell. *Oil & Gas J.*, 2.1.36, **34** (33), 13–14.—This area is situated east of the Hunton Arch, north of the Ouachita Mtns. and west of the southern end of the Choctaw Fault. A test well has been drilled which reached the Simpson at 6710 ft., but no production was found. When the mud was removed from the hole, salt water emerged. The origin of the latter has not been decided, but from laboratory tests carried out on samples of the Simpson it is not thought to have originated in this formation, but from a higher horizon.

The area is one that has suffered considerable folding and faulting, and the sediments of post-Pennsylvanian age seem to have been more affected by movement than those of the Mississippian and older formations.

The location of the test well seemed so favourable that it is difficult to explain its failure. It may be that the Simpson is too tight, or that the well was placed too far down the flank of the Hunton Arch. It has been stated, however, that there are definite possibilities of Ordovician production similar to that obtained in the Fitts Pool, which lies about 12 miles to the east.

When the carbon-ratio theory is applied to this area it seems that oil and gas will be definitely absent south of the Choctaw Fault, and only a possibility of gas north of it. J. A. G.

553.982 : 553(768)

196. Southern Oklahoma Prospects. C. G. Carlson and F. Swindell. *Oil Weekly*, 6.1.36, **80** (4), 37–50.—The southern Oklahoma region covers an area of 3500 sq. mls., being bounded on the north by the Arbuckle and Wichita mountains, and by the Red River uplift on the south. Its 41 fields have produced 430,000,000 brl. of oil. The first well was drilled in 1888, and found a little black, asphaltic oil. Oil seeps were known in west Carter county and north Marshall county, and attempts at commercial development began in 1903. Lawton pool was discovered in 1904; Healdton pool in 1913. Almost yearly from 1913 to 1927 a new field was discovered, including Hewitt, North and West Duncan, Empire, Sholom Alechem, Fox, Graham, Tatums, and other pools of considerable importance.

The outcrops in the Ardmore–Duncan district are mainly lower Cretaceous, Permian and late Pennsylvanian. Lower Cretaceous rocks cover Bryan, Marshall and most of Love county. Excepting an area round Criner Hills and territory adjacent to the Arbuckle mountains, late Pennsylvanian and Permian Red Beds cover the remainder of this part of Oklahoma, apart from recent alluvium along some river valleys. Along Turkey Creek in Marshall county are exposed rocks from the Sycamore to the Viola limestone.

The lower Cretaceous averages 1000 ft. thick in Marshall county, the basal Trinity sand being transgressive, coarse and, at times, conglomeratic. At its northern edge in the Arbuckle mountains the Cretaceous rests on granite and lower Palæozoics. The Permian and Pennsylvanian are thinnest in Comanche and Stephens counties along the south-eastern extension of the Wichita mountains, and over the buried hills of Ordovician rocks, such as Healdton, Hewitt, Loco and Velma. North and south from the Criner Hills–Wichita uplift the Permian Red Beds thicken. They become thin again south of the Red River over the Electra Arch in north Texas. Between the Criner Hills–Wichita uplift and the Electra Arch, late Pennsylvanian beds overlap on granite or schist, and beds from Cambrian to early Pennsylvanian, and in the Wichita mountains Permian beds rest on granite, and Ordovician and Pennsylvanian sediments. The Deese formation attains a thickness of 7000 ft. in Love county, and it is estimated that if all the Permo-Pennsylvanian beds were present at any point in the Ardmore basin, they would total 20,000 ft.

The two main periods of folding were late Mississippian–early Pennsylvanian, and late Pennsylvanian. The earlier folding was stronger south of the Red River in Texas, and over the region of the Wichita mountains and the buried hills of the south-east. The folds west and north-west of the Arbuckle mountains are thought to be late Pennsylvanian. Some movements also occurred in the late Permian. Folds range from gentle to overturned.

Most production is related to anticlines which are reflected in the late Pennsylvanian or Permian beds at the surface. West of the Arbuckle mountains are several small pools where oil is trapped by the overlapping of Permian or late Pennsylvanian beds on older rocks, *e.g.* Wildcat Jim, Cox, Homer and Roundup.

Oil is obtained chiefly from the Deese and Dornick Hills formations of lower Pennsylvanian age. Permian sands are productive south-east of the Wichitas. In Marshall county a little black, heavy oil was obtained from the base of the Cretaceous. In general, the oils decrease in density with increase in depth. It is likely that the Healdton pool obtained oil from both the Viola limestone and the underlying Simpson, and the Hewitt pool also may have given Viola production. There is evidence of a major accumulation of oil in the Ordovician of the old Fox field. The main hopes lie in the discovery of Ordovician production in fields now producing from younger beds, as well as new untested structures, such as buried hills away from the main uplift and at greater depth. Overlaps will be important.

Several "highs" have been located by means of seismographs. On the south side of the Arbuckle mountains the Simpson sand outcrops are frequently bituminous, but doubts are entertained as to its significance. Impregnation may be by downward migration from the unconformable Cretaceous, or by upward migration from the Ordovician. G. D. H.

553.982 : 553(781)

197. Relation of Structure to Production in the Oil-fields of Western Kansas. C. R. Thomas. *Oil & Gas J.*, 16.1.36, **34** (35), 14–15.—During recent months several surface structures in this area have been tested with little success. As a result, it was thought that structures represented at the surface bore no relationship to the folding in the Pennsylvanian and older formations. The author admits that some of the deep-seated and stronger folds are masked to a certain extent by later superficial movements, but states that structure is the main factor governing oil accumulation in this area, and not variable porosity, as was at first thought.

The deeper-producing horizon is probably Arbuckle Limestone, but this has not been determined with certainty, and it is thought that the Gorham and Rush County Sands may be Reagan.

Two maps are given of the Barton Arch, one based on the Arbuckle with 100 ft. contours, and a similar one on the Dakota Sandstone. In the opinion of the author, the Barton Arch appears to connect through the Stockville and Chadron anticlines with the Black Hills and through the Chautauqua Arch with the Ozarks.

Of the various highs on the Arch, the Aldrich and the Wakeeney pools appear to be on a strong N.E.–S.W. fold parallel with the axis of the main arch. The Rush County gas high may also be placed on this line. The Ellsworth Arch forms the S.E. boundary of the main Barton Arch, and most of the pools discovered on this structure are situated near the axis. Poor exposures and unsatisfactory seismograph work make it doubtful if the top of the structure has been found. The Cambridge Anticline probably lacks Ordovician sediments, and has only a shallow section of Pennsylvanian. In places wells have passed directly from Pennsylvanian to Pre-Cambrian schists. Although the Pennsylvanian is thin, it is very favourable to the origin and accumulation of oil. J. A. G.

Geophysics.

550.831 : 553.982

198. Economic Possibilities from Mapped Gulf Coastal Plain Are Many. E. H. Sellards. *Oil Weekly*, 11.11.35, **79** (9), 44.—The importance of establishing the position of underground formations cannot be exaggerated. Gravity readings recorded at the various points suggested by Baker (Abstr. 198) must enhance enormously the study of underground conditions. At present it is difficult to estimate the economic possibilities of the deposits underlying the region adjacent to the Gulf of Mexico, but developments to date indicate that they should be vast. The proposed gravity survey would blaze the trail and start the determination of the underground conditions, on the absolute correct mapping of which so much depends in the development of this part of the United States. B. F. N. M.

526.7

199. Absolute Gravity Survey in Gulf Coast States would be of Great Value to Petroleum Industry. W. L. Baker. *Oil Weekly*, 11.11.35, **79** (9), 38.—The value that could be derived from an absolute gravity survey of the Gulf Coast States is stressed, and it is suggested that the U.S. Coast and Geodetic Survey should erect monuments or bench marks with elevations above sea level at intersections of longitudinal and latitudinal lines at one degree intervals. Also that the Survey should determine the value of absolute gravity at nearly 1200 points. A map indicates the positions of the proposed monuments and of the 1200 stations. The estimated cost of this Survey is put at between $500,000 and $750,000.

These absolute gravity stations will give a reliable foundation in the Gulf Coast States for more regional interpretation of gravity surveys already made and others yet to be made. B. F. N. M.

550.835

200. Determination of the Gas Content of Horizons by the Radioactivity of the Minerals. A. Snarskii. *Azerb. Neft. Khoz.*, 1934, 11–12, 28–34.—On the basis of some experiments reported in the paper, the following conclusions were reached: (1) The radioactivity of minerals containing crude oil is of a sedimentary character; (2) Minerals of increased radioactivity may be considered as indicators for the presence of gas; (3) Activity of individual mineral samples is possible, but it is due to inclosures of radioactive elements; (4) An increase in the activity of water-containing horizons is possible, and such horizons, if they contain gas, can be determined by means of prospecting, being characterized by their electrical resistance; (5) In the absence of suitable apparatus for determining the α-emanation, the soil will show a blurred maximum (by the Schlumberger method); (6) Because of diffusion properties of the gas through the minerals, and in the case of its activity and an accumulation in the upper mineral layers, the air will be activated, and the latter fact can be utilized for investigating the presence of gas and oil. For. Petr. Techn.

553.631 : 550.83

201. Relation of Geophysics to Salt Dome Structures. W. M. Barret. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1069.—Barret disputes Eby and Clarke's (*B.A.A.P.G.*, 1935, **19**, 356) inferred conclusion that magnetic results obtained on the Fannett Dome, in Jefferson County, Texas, discredit the magnetic method for use in locating salt dome structures. (Magnetometric Profiles of two salt domes in Louisiana are figured.)

The author's reply states that, with only one (unproved) exception, they know of not one salt dome discovery on the Gulf Coast credited to magnetics.

Barret states that the little magnetic exploration on the Gulf Coast is negligible in comparison with gravimetric and seismic surveys, and was conducted when instrumental equipment and interpretative skill were inadequate. B. F. N. M.

553.982 : 550.83

202. Scientific Methods of Exploration for Oil Help Industry Meet its Demands. Anon. *Oil & Gas J.*, 19.12.35, **34** (31), 13.—The author starts by claiming that the advent of the geologist and geophysicist into the oil industry has saved the world from a severe shortage of the valuable products obtained from crude petroleum, which could not have been economically and satisfactorily met by synthetic substitutes. Until the scientists invaded the problematical and also the producing oil-fields, wells were located in proximity to surface indications of oil, without any knowledge of the causes of the surface signs or of the geological structure; many were even chosen on mere childish superstition, and some on blind trust in "luck."

Then first the geologist came on the scene, and he, by interpreting the geological structure from the surface rock exposures, was able to prevent much absolutely hopeless "wild catting" and indicate structures with promise of oil. He was followed by the geophysicist, whose instruments indicated sub-surface conditions, which, interpreted with geological knowledge, opened up many rich oil-fields, such as those in Texas and Louisiana, with reserves estimated, at this date, at 200 million and 70 million barrels of oil for future recovery.

Geophysical work in the U.S.A. in 1935 is estimated to have cost more than $16,000,000, an increase over 1934, which appears to be likely to be progressively greater in future years.

Not until 1914 were any appreciable number of geologists employed by the oil companies in the U.S.A., although in 1885 Dr. White published his conception of the anticlinal theory of gas and oil accumulation.

In 1923 geophysics began to be used to an increasing degree, largely due to the success attending geophysical methods in delineating the many salt domes of the Mexican Gulf Coast.

Of the several geophysical methods, only the Magnetic, Gravimetric, Electric, Torsion-Balance, Pendulum and Seismograph are used for oil prospecting. A brief account of the principles of three of these is given.

A history of the changes in the geological departments of the oil industry since 1915 is given, with the costs of geological surveys and reports prior to the prevalence of

geophysical methods, and the article concludes with a table showing the expenditures in the U.S.A. on five types of geophysical methods as being, during 1934, $11,000,000 and in 1935 $16,000,000. B. F. N. M.

553.982 : 550.83

203. Geophysical Prospecting for Oil in 1935. E. de Golyer. *Min. & Metall.*, 1936, **17**, 62.—Geophysical surveys were increasingly used, and met with substantial success in oil prospecting during 1935.

The greatest activity continued in the Gulf Coast of Texas and Louisiana by means of gravity surveys and shooting. A sharp increase in reflection shooting was marked in California, Oklahoma, Kansas, Colorado, Wyoming and Nebraska and Southern Arkansas, Northern Louisiana and Eastern Texas were also very busy.

Gravity methods fell off slightly. Seismic surveys by the reflection method increased considerably. Refraction surveys were again made for preliminary exploration in swampy regions. Electrical surveying was also used. Practically all the seismic crews in the U.S.A. are doing reflection work. Geophysical work in Mexico was hampered by the restrictions placed by the Mexican Government on the immigration of trained men.

No accepted geophysical method yet proved claims to do more than discover and map structure.

A notable success in getting oil after seismic survey indicated favourable structure was the Monument Pool in New Mexico. Another success was the discovery of the Martinsville Pool in Louisiana. The area was surveyed seven times by the seismic method and once by the torsion balance before the Dome was located.

Good results were also obtained on the Dog Lake Dome, Louisiana, the Anahua pool, Texas, Hastings Pool, Laxitte, Tepetate, Chequeville, in Louisiana, South Houston, Placedo, Mauritz, Pierce and East Benard in Texas. A large gas well was brought in at Grambling, Louisiana. Geophysical methods were responsible for fifteen small oil-fields in Oklahoma and four structures in California obtained gas.

Seismic methods were used in the majority of these cases. B. F. N. M.

Drilling.

622.24

204. Elwood Ocean Drilling. B. Mills. *Oil Weekly*, 13.1.36, **80** (5), 25.—About half the Elwood field lies under water and pier construction, multiple drilling from pier foundations and deviated drilling have reached a most advanced stage.

An unusual combination involving a large unit or battery of well foundations and the application of deviated drilling has been developed by the Pacific Western Oil Company. Although all drilling is not done from one location, the foundations are so close together that pier construction is reduced to a minimum. Seven wells have been drilled from one foundation unit that consisted of twelve caissons and five cellars. The caissons were arranged in two rows of six. Two wells were drilled in the first or inside cellar, one well on each in the second, third and fourth cellars, and two wells on the outside cellar. After the first well was drilled the derrick was skidded only 18 in. to place it over the second well in the same cellar. Two 26-in. conductors were driven vertically in the first cellar and one well was drilled in each conductor.

Skidding the rig to the other locations gave a row of seven producing wells in a straight line only 96 ft. in length. L. V. W. C.

622.24

205. Redrilling and Cleaning-out Operations. F. B. Taylor. *Petr. Eng. Dec.*, 1935, **7** (3), 84.—An increased demand for oil in East Texas has caused activity in this shoestring area. The most interesting features are the cleaning-out methods and the manner of handling the gas and oil production.

Gas development has been hindered by the small volume of gas produced and by reason of the fact that gas wells must be produced at a fraction of their potential due to water difficulties.

The old wells that have been reopened have required, in many cases, the installation of new casing. This reconditioning has been carried out with a spudding machine,

new pipe being driven and, where necessary, the face of the sand cleaned. Pumping jacks are used for production, and the crude has to be hauled from most localities owing to the scattered nature of pipe-line facilities. L. V. W. C.

622.242.2 : 621.313.1

206. Electric Drilling Economies at Elwood. L. S. Peterman and R. E. Johnson. *Petr. World*, (LA), 1935, **32** (11), 149.—Using electric drilling equipment, the Pacific Western Oil Co. have drilled a 3657-ft. well from an ocean pier near Goleta, California, at a cost of $242.90 for electric energy purchased from an electric supply company. The connected H.P. was approximately 315 and the kW. hours consumed were 41,322.

The Pacific Western has constructed four parallel steel piers at regular intervals out into the ocean, and the wells are drilled with standard rotary rigs at predetermined spacings on the piers. The piers are served on individual pole-line feeders from a 2300-volt, 3-phase, 50-cycle main circuit running parallel to the shore line past all four piers. Service to the rig is taken from the individual 2300-volt pier feeder through a pole-mounted oil-circuit breaker to a unit control house. The control unit is a small portable sub-station mounted on steel skids.

A list of the major electrical equipment is given; this is operated on 440-volt, 3-phase, 50-cycle supply. The drilling motor is rated at 200/67 H.P., mounted on a common base with a reduction gear. A chain drive is taken to the draw-works. 6½-in. × 14-in. mud pumps serve two of the piers from a convenient shore location, the remaining two piers being served by individual shore-mounted sets of steam pumps which continue to be used because they were equipment already on hand. Servicing of the wells is accomplished by a portable electric pulling equipment mounted on a truck chassis.

A description of the electric equipment is given, together with costs on other wells. W. W.

622.243.5

207. Carbon Dioxide Gas Well Successfully Completed with Rotary. L. G. E. Bignell. *Oil & Gas J.*, 5.12.35, **34** (29), 13.—Drilling by rotary in the Colorado district for natural gases containing large amounts of carbon dioxide is a new departure. The formations dip as much as 42 degrees from the vertical, and it was found impossible to drill a straight hole with an 11¾-in. bit in 6¼-in. drill-pipe, but possible to drill a straight 9-in. hole, which was later reamed to 11¾ in., to 5068 ft.

The formation pressure was controlled by the weight of the column of mud, and 91 ft. of sand were penetrated.

The well came in making 3,500,000 cu. ft. of carbon dioxide gas and 65 brl. of 56 gravity oil daily.

The gas was prevented from suddenly expanding and freezing by maintaining the mud pressure in the well at all times.

The composition of the gas produced is: Methane 0·52, ethane 3·95, carbon dioxide 92·14, oxygen 0·09, nitrogen 3·16 and helium 0·14%. The carbon dioxide gas is utilized in the manufacture of liquid carbonic acid, fire extinguishers, etc. L. V. W. C.

622.243.7

208. Controlled Directional Well Drilling and Surveying Practice, Part V. J. D. Hughes. *Petr. Eng.*, Dec. 1935, **7** (3), 32.—Several types of bits are used in directional drilling, and each has a distinctive use and place in the practice. These are: follow-up bit, pilot reaming bit for soft and hard formations, spoon-bill bit, pine-apple bit and disc bit.

The means of setting the whipstock so that it will drill off in the required direction is the second requisite of controlled directional drilling. In a reasonably vertical hole a whipstock can be set to drill off in any given direction, and as the dip angle increases, the minimum theoretical turn obtainable from the whipstock without altering the drift angle decreases.

An analytical construction of vectors enables the direction of facing the whipstock

for a required direction of drilling to be determined. The method of doing this is illustrated. L. V. W. C.

622.245.49 : 608.3

209. **Patents on Drilling Plant.** J. F. Robinson, J. M. Chilcote and W. H. Haupt. U.S.P. 2,024,662, 17.12.35. A cementing apparatus for cementing wells consisting of a contraction in the lower end of the casing into which fits a tapered ring having a guiding surface tapered in the opposite direction. A number of vanes are attached to the lower end of the ring for distributing the cement.

622.24.051.4 : 608.3

O. Hammer. U.S.P. 2,024,730, 17.12.35. A core breaker comprising a roller having teeth milled on it, the roller being placed so that it can rotate about an axis which is upward and inwardly inclined to the axis of the drilling bit.

622.245.17 : 608.3

H. E. Grace. U.S.P. 2,025,047, 24.12.35. A handle guard for casing elevators. This guard is in the form of a spider projecting out from the handle, and located between the handhold and the adjacent link.

622.243.55 : 608.3

J. A. Zublin. U.S.P. 2,025,258, 2,025,259, 2,025,260, 2,025,261, 24.12.35. A gyratory well-drilling bit, the cutting body adapted for rotation on it with cutting blades extending outwards from the body, the edge portions of the blades being angularly directed inwards and forwards in the direction of rotation of the cutter relative to the formation being drilled. L. V. W. C.

Production.

622.276.4

210. **Hydraulic Power Applied to Oil-Well Pumping.** C. J. Coberly. *Petr. World*, 1935, **32**, 307–313.—This article is from a paper presented at the 16th Annual Meeting of the A.P.I. at Los Angeles, November 1935. Hydraulic-power transmission, which has been applied to other industries, is adapted to oil-well pumping. Oil is used as the hydraulic fluid. The equipment includes means for separating gas, water and solids from the operating fluid and a pump for supplying fluid under high pressure. The sub-surface unit is a reciprocating engine direct-connected to a double-acting reciprocating pump. The unit is carried by a macaroni string of tubing and inserts within the regular production tubing. High efficiencies and low operating costs are attained. Fluid levels may be determined or automatically controlled.

A general description of the equipment is given, together with details of construction and operation. Capacity limitations and design problems are dealt with, and a summary of field tests is included. W. W.

622.276

211. **Mid-Continent Flooding.** J. C. Albright. *Oil Weekly*, 23.12.35, **80** (2), 30.—A water-flood project has been started by the Forest Production Corporation in North-eastern Oklahoma to recover a portion of the estimated quantity of oil which still remains in the ground.

All the old wells have been plugged, and new ones are being drilled exactly 330 ft. centre to centre; thus 45 wells will be drilled for the first 80 acres. The entire 160 acres will have 81 input wells and 64 producing wells.

Small portable rigs are used for drilling the input wells, and after the completion the hole is shot with 50 quarts of glycerine to open up the sand. Cement-lined casing, 5 in. in diameter, is run and 1¼-in. tubing completes the well.

The water to be used for flooding is treated to ensure that it will not leave deposits on the sand face, and so reduce the input rate.

The delayed flood plan is being adopted, and all the water will have started into the sand through the input wells before the oil wells are drilled. L. V. W. C.

622.276.4

212. Pumping Slanted Holes. B. Mills. *Oil Weekly*, 23.12.35, **80** (2), 24.—The cost of pumping the deviated wells at Huntington Beach is only slightly higher than the average for ordinary pumping wells in the field. The problems are more complex, but the mechanical difficulties are considerably less than were anticipated. In many of the deviated wells pumping costs have been less than in offsetting wells that were completed as straight holes.

Few rod breakages and no cases of parted tubing have been reported, and it is assumed that the holes have held to their courses, forming few sharp bends and with a gradual and regular increase in vertical angle. Most trouble has been experienced in holes of the dogleg type. L. V. W. C.

622.276.4

213. Casing Pumps in Winkler Field. J. C. Albright. *Petr. Eng.*, Dec. 1935, **7** (3), 29.—The Winkler field of West Texas is producing more water per brl. of pipe-line oil than perhaps any other field in the world, the approximate amount being 500,000 brl. of water every 24 hours.

Many of the wells are still considered profitable producers of oil, although they have ceased to flow and a large number have been placed on the pump. The tremendous volume of water produced with a small percentage of oil has necessitated larger pumps and working barrels to maintain production.

Large-diameter casing type pumps are utilized. These pumps employ no tubing, the working barrel being inserted in the casing, and held at the desired depth, and packed off at the top by means of a special packer. A special unloading device, called a drain sleeve, is built into the pump to enable the casing barrel and rods to be pulled after the column of fluid above the travelling valve has been equalized. L. V. W. C.

622.276.4

214. Pneumatic Pumping. J. C. Albright. *Oil Weekly*, 30.12.35, **80** (30), 35.—Several installation features have been developed by the engineers of the Pure Oil Company for the pneumatic units now being used for pumping purposes.

The units, including compressors, air lines and pumping heads, are designed so that a number of wells can be operated. A varying stroke pumping from a few inches up to 72 in. is possible with the pumping head, and the upstroke can be regulated from a few strokes per minute with the return stroke falling rapidly or vice versa, or the stroke may be operated with a uniform travel both up and down, as conditions may dictate.

A gas-engine-driven compressor supplies the air, and the number of wells operated from one compressor is usually three. Air at 75 lb. is transferred to the high-pressure end, which delivers a pressure of about 250 lb. The high-pressure air is heated by being passed through a jacket surrounding the exhaust pipe of the engine. Any moisture in the air is collected by an accumulator installed in the line.

The heads used have a full length stroke of 72 in. They are suspended in the derrick, and are fashioned so that cushioning devices are integral with the unit and valves. The stroke can be regulated to give a rate of 35 strokes per minute, whilst the down stroke may be set to give a rate of 3 strokes per minute.

Shock is eliminated by cushioning by the cut-off valves. L. V. W. C.

622.276.4

215. Combination Gas-Lift and Pumping Practice. J. C. Albright. *Oil Weekly*, 13.1.36, **80** (5), 37.—Artificial lifting methods have become necessary in several areas of the Oklahoma City field owing to the enormous drop in bottom-hole pressure, and a combination of gas lift and pumping has been used advantageously.

The method consists of using bottom-hole electrically driven centrifugal pumps for lifting the oil about 1000 ft., and then applying gas lift for carrying the fluid the remaining 5000 ft. A regulation type bottom-hole submerged electric pump is set in the bottom of the tubing string, which is perforated at about 1000 ft., and the tubing is packed off beneath the perforations. Gas lift then begins to function, and brings the oil to the surface. L. V. W. C.

622.276.4

216. Petroleum Solvents Used to Remove Paraffin Deposits in Flow Strings. H. K. Ihrig. *Oil & Gas J.*, 5.12.35, **34** (29), 37.—Favourable results have been obtained by the use of high-gravity petroleum solvents for removing paraffin from flow strings of oil wells. The use of gas lift has accelerated the deposition of wax, which is not usually found at depths greater than 2000 ft. Wherever there is a cooling action, however, wax will accumulate.

The solvent is pumped into the well, and in the case of gas lift the fluid is surged up and down the hole several times to permit washing the flow string throughout its entire length. The solvent, which is a product of the natural gasoline plants in the field, has a vapour pressure of 26 lb.

Two methods of treating wells are practised, depending on whether the annular space between the tubing and casing is to be treated, or whether the inside of the tubing is to be cleaned. Where the well to be treated is producing through the tubing, the solvent is pumped into the tubing, and after it has had an opportunity to reach the bottom of the string, the well is put on production until the fluid reaches the top of the hole. The well is then shut in and the slug of solvent driven down the tubing past the accumulation of wax, when the solvent is again brought to the surface.

From 1000 to 2000 gallons of solvent are used for treating in the annular space.

A considerable quantity of the wax removed is not in solution in the solvent or in the fresh oil from the sand, and on being put into the tanks with the oil it promptly settles out.

Very little change has been noted in the gravity of the oil in the tanks after the addition of the solvent. L. V. W. C.

622.276.95

217. Gas Drive and Storage Project. J. C. Albright. *Oil Weekly*, 13.1.36, **80** (5), 31.—Gas produced in the Burbank field is processed, and is then returned to the producing district under two pressures, to the drilling wells and other units needing gas for fuel at 35 lb., and the remainder boosted to 170 lb. for sand-injection purposes.

The gas is passed through a scrubber to clean it before it enters the suction line of the high-pressure gas engines. A release manifold is built into the system so that the pressure can be released from both the intake and discharge lines between the engine compressors and the intake and discharge headers.

Each input well is equipped with an individual meter to record the gas passed to it, and a high-pressure steel stop enables the amount of gas to be controlled.

Wells are being drilled strictly for input purposes, completed through the sand, cased in the regular manner and cemented so that the gas will not migrate to other zones. L. V. W. C.

622.276.95

218. Combined Repressuring and Flowing Unit Installed in Noak Field, Texas. G. Weber. *Oil & Gas J.*, 21.11.35, **34** (27), 48.—A new compression unit which fulfils the dual purpose of flowing wells and maintaining reservoir pressure has recently been installed in the Noak field, Texas.

The gas-gathering lines from the separators converge at the compressor plant, which consists of a two-stage compressor powered by gas. The gas is cooled between the low and high stages, and all traces of liquid are scrubbed out. The gas leaving the second stage is charged directly to the high-pressure field line without further cooling. This line connects to four flowing wells and the intake well. L. V. W. C.

622.276.95

219. Repressuring Depleted Oil-producing Sands in Kentucky. R. C. Conine. *Oil & Gas J.*, 12.12.35, **34** (30), 35.—The repressuring of the depleted oil sands in Kentucky is undertaken without any definite conclusions as to the results that may be obtained, owing to the fact that no cores of the sands were taken or packers placed when the wells were first put on production. These operations are now being undertaken by the operators, and a skid type repressuring test unit is being used from the start to check repressuring and the oil-producing potentialities. L. V. W. C.

622.323 : 681.121

220. Metering Production from Individual Wells. W. A. Sawdon. *Petr. Eng.*, Dec. 1935, **7** (3), 36.—The need for greater accuracy and economy in measuring individual well production has resulted in the use of meters in the California fields.

A number of types of meters are in use, and in most cases the oil meters take samples of the oil as it passes through the instrument. Many of the samples are continuous, and it makes no difference what the changes in the character of the fluid may be.

The displacement meter has been designed to handle production from either pumping or flowing wells. It is placed in the line in the down-stream side of the trap. The flow line remains a closed system from the intake, through the meter and to the discharge, whether the production is under pressure or flowing by gravity.

The gravimetric meter operates on the principle that the unit weight of a given gravity of oil remains constant under all conditions. Two kinds are being used : the open and the closed types. The open type is applicable for measuring low-gravity oils, whilst the higher gravity oils can better be measured with the closed type to prevent evaporation loss.

The orifice meter and the velocity type of meter are both being used on the high-pressure wells in the Kettleman Hills. These are measuring oil that has a high gas content under pressure. L. V. W. C.

622.323 : 681.121

221. Crude Measurement. B. Mills. *Oil Weekly*, 30.12.35, **80** (3), 15.—The methods for measuring sampling and testing crude oil which have been developed in California do not differ radically from those prevailing in other areas.

The 100% tank table is used exclusively in California, the purchasing company always allowing the seller the prevailing price for 100% of the oil in the tank. The shrinkage or loss is charged to a definite account, and is not passed on to the purchaser.

All tanks in California are gauged with steel tapes and plumb bobs, and a number of sampling methods are in use. One of the methods is equivalent to coring a section from the top of the oil to the outlet level. A three-foot thief is run to the bottom and the net cut of the oil column determined. Another method involves the use of a small thief that obtains samples at short intervals throughout the oil column.

Oil is now purchased in most of the California fields on a true gravity basis. The samples obtained are tested by one of two methods. Several companies are using a phenolized benzole, whilst others employ a special chemical which contains phenol, benzole, castor oil and commercial dehydrating agents. L. V. W. C.

665.514

222. Oil Treating Considered an Operating Problem. W. B. Lerch. *Oil & Gas J.*, 12.12.35, **34** (30), 28.—The treatment of emulsions is one of the important operations in the production of crude oil which cannot be obviated. Since the introduction of gas lift methods, new and greater difficulties in the treatment of emulsions are encountered.

Oil-field emulsions are the water-in-oil type, and the degree of emulsification depends on the fineness of the emulsion particles, together with the manner in which the emulsion is formed. In general, the higher the pressure in the well the greater is the agitation and the finer the emulsion.

Three general methods of treating are available—chemical, electrical and mechanical—and these are considered, together with the occasions on which each can be used with the greatest success. L. V. W. C.

665.514

223. Avoidance and Treatment of Crude Oil Emulsions. R. G. Ralph. *Oil & Gas J.*, 19.12.35, **34** (31), 56.—The formation of crude-oil emulsions is due either to gas agitation in the well, in the case of natural-flowing wells, gas lift wells and pumping wells which flow off, or to the oil and water being forced at high velocities through relatively small orifices, which may be caused by creased cups, leaky balls and seats, leaky tubing, chokes or too small a lead line. In many cases the emulsion trouble may be prevented by reconditioning the well equipment.

The more important methods for treating crude oil emulsions include : 1. *Electrical*

methods, which are quite common in the Gulf Coast and California fields, but are not used extensively in the Mid-Continent fields. They are best applied to asphalt-base crude oil emulsions; 2. *Mechanical* means, which are not used at the present time; 3. *Chemical* methods, which are the most widely used in the Mid-Continent fields, the main factors involved being: (*a*) quantity of treating chemicals; (*b*) sufficient agitation; (*c*) heat if required; (*d*) water wash if required.

(*a*) The type of chemical required for any crude-oil emulsion must be ascertained beforehand from laboratory tests. (*b*) The chemicals may be applied (1) down the hole, in order to prevent the emulsion forming; also sometimes eliminating scale formation on producing equipment, (2) to the lead line as near the well as possible, or (3) to the oil in a tank, this not being recommended except in emergencies. When tank treatment is used, agitation is provided by the gas coming through the lead line with the oil, if necessary supplemented by a gas spray from the lease supply. In cases where the water is very finely divided, filtration through gas or excelsior beds is carried out. (*c*) Heating is employed in many cases, the demulsification being due to (*a*) the melting of the paraffin particles which act as emulsifiers, (*b*) settling of water by reduction of the viscosity of the oil. It also results in elimination of paraffin bottoms. Heating may be by boiler heater, ground heater, thermosiphon, steam or direct heating. C. L. G.

622.276.4 : 608.3

224. Patents on Production Apparatus. J. Evans. U.S.P. 2,024,850, 17.12.35.—A plunger-lift device consisting of a string of tubing and a flow head. The tubing has discharge openings into the lower end of a nipple which is attached to the flow head. A plunger, operated by pneumatic pressure, works in the string, and comes into contact with a resiliently mounted stop plate at the lower end. L. V. W. C.

Pipe-Lines.

622.698

225. Pipe-line through Indian Jungle. Anon. *World Petr.*, 1935, **6**, 675–679.—An account of the construction of the 166-mile welded 8-in. pipe-line from Tempino to Pladjoe, Netherlands East Indies. Work started on the line in November 1934. By the beginning of October 1935, the pipe-line was welded in its entirety. W. W.

622.698

226. Tide Water's New Ocean Terminal. J. W. Thompson. *Nat. Petr. News*, 25.12.35, **27** (52), 34.—The new ocean terminal of the Tide Water Oil Company on the Chelsea river, at Revere, near Boston, Mass., is described. A feature of the terminal is the piping arrangement, which is set out so that each product is handled separately, thus eliminating the possibility of contamination. Three grades of gasoline, two grades of fuel oil, and kerosine are handled at the terminal, which has a tankage capacity of 18,000,000 galls. W. W.

622.698

227. Operators Build Efficient Paraffin-treating Unit. H. K. Ihrig. *Oil & Gas J.*, 21.11.35, **34** (27), 26.—Rapid deposition of paraffin in the lead lines from the wells in Greenwood County, Kansas, has led to the development of an efficient paraffin-treating unit.

This unit is mobile, and therefore convenient for use in the small pools of this area. Paraffin solvents made at the Company's refineries and high-gravity gasoline are pumped into the line using the power from the mobile unit. 100 gallons of the treating fluid are pumped into the lead lines, and the time required for a complete treating ranges from one to one and a half hours, depending on the distance from the well to the storage tanks at the plant. L. V. W. C.

622.698

228. Power for Pipe-line Pump is Secured through Economical Installation. H. K. Ihrig. *Oil & Gas J.*, 21.11.35, **34** (27), 24.—A novel method for operating a pipe-

line pump has been developed in the Greater Seminole area. The pump is installed in a rod line between a backside pumping unit and a pumping jack. When a tank of oil is to be pumped into the pipe-line, a short pitman is rotated to a horizontal position and connected to the piston reins of the pump.

The discharge stroke of the pump is made when the rods in the well are moving upwards, and the suction stroke is brought about by the fall of the sucker rods.

L. V. W. C.

622.698

229. Permanent Pipe-line Reconditioning Plant Utilizes Heat and Sand Blast. N. Williams. *Oil & Gas J.*, 28.11.35, **34** (28), 28.—The Houston Pipe Line Co. of Texas has established a central reconditioning plant for the cleaning and reclamation of replaced pipe from the Company's gas lines.

The plant makes use of the sand-blast method of cleaning, but the cost of this operation has been reduced to a minimum. An unlimited supply of river sand is available for the cost of hauling, and power for running the air compressors is furnished by the booster stations auxiliary gas engine and generator. L. V. W. C.

622.698 : 620.197

230. Latest Gasoline Line. H. H. King. *Oil Weekly*, 30.12.35, **80** (3), 17.—The problems presented by the extension of the Keystone Pipe Line Company's gasoline pipe-line system from Eastern Pennsylvania to Pittsburgh have been termed the most difficult in the United States.

The line passes over the Appalachian Mountains, and five major river crossings were made. Many of these crossings required blasting crews to enable the line to be buried below the stream-bed.

Where the water was of a corrosive nature, special protective precautions were taken. The pipes were coated with three applications of hot enamel insulation and wrapped twice with asbestos paper. After testing for leaks, the entire section was encased in a specially treated redwood box, which was filled with a coal-tar product.

L. V. W. C.

Gas.

621.791.5

231. Total Oxygen Requirements Determine the Choice of Fuel in Steel Cutting. G. V. Slottman. *Oil & Gas J.*, 30.1.36, **34** (37), 52.—The results of an investigation into the operating characteristics of city gas, natural gas, propane, and acetylene for steel cutting are discussed. Practical tests in a variety of oxy-fuel cutting torches in cutting mild steel plate of ¼–4-in. thickness were made, involving a study of: (1) the effect of the oxygen–fuel gas ratio on the rate of heating, (2) the comparative rates of heating of various oxy-hydrogen flames, (3) the cutting oxygen requirements, (4) the total oxygen requirements to produce equivalent cuts in steel with the above fuel gases.

The operation of cutting steel consists of (1) preheating an area of steel surface to the ignition temperature with an oxy-fuel gas, and (2) severing the steel under the preheated area with an oxygen stream. It is shown that per unit of heat developed, oxyacetylene flames preheat steel faster than any other commercially available fuel gas, and require the least amount of oxygen for its combustion. Where equivalent cuts are made in steel, the total oxygen consumption with acetylene is considerably less than with any other fuel gas. The hydrocarbon gases require complete combustion with oxygen in order to generate their maximum flame temperatures (5000° F.), whereas acetylene, owing to its high endothermic heat liberation, reaches 6000° F. with an oxygen gas ratio of less than 50% of that required for total combustion. The heating value cannot therefore be used to assess the cutting value, owing to the varying flame temperatures and heating efficiencies developed when the gases are burned with oxygen. C. L. G.

Crude Petroleum.

665.51 : 535.371

232. Geochemistry of Crude Oils and Bitumens of the Volga–Ural District. I. V. Postovskii, I. M. Polyakova and V. B. Getzen. *Khim. Tverd Topliva*, 1935, **6**, 459–471.—The fluorescence (observed in the Heræus lamp) of crude oils and bitumens differ for various sources, and may be used for purposes of identification. Many Ural crudes and bitumens produce characteristic absorption spectra corresponding to the metal complex of porphyrites. The Chusov and Ukhta crudes, as well as the adjacent bitumens, do not give absorption spectra and do not contain porphyrites. The presence of a number of Va-bitumens in the Sterlitamak and Chusov crude oils is reported, and the connection of the vanadium with the metal complexes of porphyrites is established. An asphaltite obtained from a deep oil well containing –OH groups is described. For. Petr. Techn.

665.51 : 66(763) 665.51 : 66(781)

233. Analyses of Rodessa (Louisiana) and Oxford (Kansas) Crude Oils. *Petr. Eng.* Nov., 1935, **7** (2), 55.—The results of a Bureau of Mines analysis on the above crudes is given. Rodessa crude is classified as a paraffin-base crude oil and has the following characteristics: Sp. Gr. 0·808; sulphur 0·18%; pour point 25° F.: visc., Saybolt U. at 77° and 100° F., 40 secs. 38 secs. respectively. It yields 32·1% of total gasoline and naphtha (Sp. Gr. 0·738); 20·0% kerosine distillate (Sp. Gr. 0·792); 11·9% gas oil (Sp. Gr. 0·830); 12·8% light lub. oil dist. (Sp. Gr. 0·838–0·860, visc. 50–100); 2·7% medium lub. oil dist. (Sp. Gr. 0·860–0·865, visc. 100–120); and 18·9% residuum (Sp. Gr. 0·911).

Oxford crude is classified as a wax-bearing intermediate base oil, and has the following characteristics: Sp. Gr. 0·830; sulphur 0·21%; pour point below 5° F.; visc. Saybolt at 77° and 100° F. 42 secs., 39 secs. respectively. The yields are: Total gasoline and naphtha 32·5% (Sp. Gr. 0·736); kerosine distillate 12·2% (Sp. Gr. 0·812); gas oil 16·3% (Sp. Gr. 0·846); light lub. oil dist. 10·6% (Sp. Gr. 0·865–0·887, visc. 50–100); medium lub. oil dist. 6·2% (Sp. Gr. 0·887–0·899, visc. 100–200); viscous lub. oil dist. 1·4% (Sp. Gr. 0·899–0·902, visc. above 200); and residuum 18·4% (Sp. Gr. 0·957). C. L. G.

665.514 : 608.3

234. Patents on Crude Oil. C. H. M. Roberts. U.S.P. 2,023,976, 10.12.35. Breaking of emulsions of the water-in-oil type by subjecting the emulsion to the action of an agent containing neutral phthalyl mono-olein.

665.514 : 608.3

C. N. Stehr. U.S.P. 2,023,979–2,023,982, 10.12.35 and M. De Groote and B. Keiser. U.S.P. 2,023,993–2,023,997, 10.12.35. Breaking of emulsions of the water-in-oil type by means of a compound produced by the oxidation of: (1) castor oil to the stage when it is just insoluble in kerosine, followed by dilution, with a suitable solvent; or of (2) a mixture of castor oil, one member of the rape-oil group, and one member of the cotton-seed oil group, or of (3) mixture of 75% of castor oil and 25% of sardine oil with the addition of an equal volume of kerosine and then sufficient triethanolamine to neutralise any free acidic hydrogen, or of (4) fatty compounds and dehydrated ricinoleic acid compounds produced by the dehydration of ricinoleic acid neutralized with triethanolamine to give substances of the desired characteristic qualities.

665.514 : 608.3

M. De Groote. U.S.P. 2,025,804–2,025,805, 31.12.35. Breaking of emulsions of the water-in-oil type by means of a demulsifying agent produced by oxidation of castor oil admixed with 10% of linseed oil, under 45 lb. pressure at a temperature of 120° C. The product is then neutralized by means of triethanolamine. The solvent for the agent is either a mixture of methyl alcohol and solvent naphtha or of benzole and ethyl alcohol.

665.514 : 608.3

C. N. Stehr. U.S.P. 2,026,195, 31.12.35. The agent for the demulsification of the water-in-oil emulsion consists in this case of an anhydrous mixture which is oil-soluble

at least at high concentrations, of 15–50% of blown fatty compounds, 2–15% of an acid salt of α-sulpho fatty acid, 20–60% of an unsaponified sulphur-free fatty acid, and 5–25% of an aliphatic monohydric alcohol containing at least 3 carbon atoms.

665.514 : 668.3

M. De Groote. U.S.P. 2,026,217–2,026,218, 31.12.35. Demulsifying agent to break emulsions of the water-in-oil type, comprising a sulphohendecenoic acid compound in the form of an ester.

665.514 : 668.3

M. De Groote. U.S.P. 2,026,219, 31.12.35. Demulsifying agent for the purpose described consisting of a bisulphite addition product obtained by the reaction of sodium bisulphite and linseed oil. W. S. E. C.

Chemistry of Petroleum.

547.21 : 541.42

235. Decomposition of Propane and *n*-Butane at Carbon Filaments. L. Belchetz and E. K. Rideal. *J.A.C.S.*, 1935, **57**, 2466–2469.—The experiments were conducted at temperatures in the range 1700–2000° K., the hydrocarbon vapours being passed at a high streaming velocity and low pressure (0·1 mm.) across the heated carbon filament situated at 2–3 mm. from a tellurium mirror. Thus any radicals formed, *e.g.* methylene or methyl, could react with the tellurium mirror, and secondary reactions would be minimized. The results indicated that the primary reaction at the carbon surface was one involving the splitting off of hydrogen and the production of the complementary olefin. The latter then decomposed to methylene and the next lower olefin, except in the case of 1 : 2-butylene, which is capable of further dehydrogenation to butadiene. Methylene subsequently reacted with surrounding molecules. The energies of activation for the two reactions were 93·2 kg.-cal. for *n*-butane and 94·2 kg.-cal for propane. The authors conclude that the reaction velocity is not governed by the desorption of hydrogen, but rather by some reaction taking place at collision. W. E. J. B.

547.214 : 536.662

236. Heat of Combustion of *iso*Butane. F. D. Rossini. *Bur. Stand. J. Res.*, 1935, **15**, 357–361.—An accurate value for the heat of combustion of *iso*butane was determined, as this will give data of much importance to industry and science.

The only previous determination was made by Thomsen in 1886, but the material then available was far from pure.

The apparatus, method and procedure were the same as those employed for the work on *n*-butane, and the purity of the sample was such that its heat of combustion would differ from that of an absolutely pure sample by less than 0·01%.

The heat of combustion of gaseous *iso*butane in O_2 to form gaseous CO_2 and liquid water, at 25° C. and a constant pressure of 1 atmosphere, was found to be 2871·06 ± 0·53 international kilojoules, or 686·31 ± 0·13 kilocalories per mole.

From these new data, values have been computed for the heat of formation of *iso*butane.

When combined with the data previously reported on the heat of combustion of *n*-butane, the present results yield for the reaction NC_4H_{10} (gas) = *iso*-C_4H_{10} (gas) at 25° C. and 1 atmosphere.

$\Delta H = -6{\cdot}82 \pm 0{\cdot}63$ kilojoules or $-1{\cdot}63 \pm 0{\cdot}15$ kilocalories, per mole.

D. L. S.

547.531

237. Reaction of Paraffins with Aromatic Hydrocarbons. Destructive Alkylation. A. V. Grosse and V. N. Ipatieff. *J.A.C.S.*, 1935, **57**, 2415–2419.—Paraffins can react with aromatic hydrocarbons in the presence of catalysts under mild conditions. The paraffin is split into a lower molecular weight paraffin and an olefin, " in statu nascendi," which latter immediately alkylates the aromatic hydrocarbon. Thus with 2 : 2 : 4-trimethyl-pentane and benzene there is obtained *iso*butane and *t*-butylbenzene. Other aromatics and paraffins, *e.g.* toluene and *n*-heptane, follow similar lines. With

iso-octane and benzene in the presence of aluminium chloride, the reaction proceeds at 25–50° C., whilst with zirconium chloride a temperature of 50–75° C. is necessary. The chlorides act as true catalysts and are promoted with hydrogen chloride, but form addition compounds with the aromatic hydrocarbons. Full experimental details are given. W. E. J. B.

547.313.2 : 541.64

238. Kinetics of Ethylene Polymerization. II. H. H. Storch. *J.A.C.S.*, 1935, **57**, 2598–2601.—Several methods of preparing pure ethylene were tried in an unsuccessful effort to obtain reproducible rates of polymerization. The addition of about 0·1% of ethyl mercaptan reduced the rate of polymerization about tenfold, but did not eliminate the induction period observed with mercaptan-free ethylene. The induction period was markedly decreased, however. The polymerization of ethylene is considered to be not a simple bimolecular reaction. The somewhat inconclusive evidence re the primary product formed indicates that butylene precedes propylene. The activation energy of the reaction, calculated from experiments at 377° and 393° C., was 43,500 cals. W. E. J. B.

547.3234.2

239. Addition of Hydrogen Bromide to Methyl Acetylene. M. S. Kharasch, J. G. McNab and M. C. McNab. *J.A.C.S.*, 1935, **57**, 2463–2465.—The normal addition of hydrogen bromide to methyl acetylene produces exclusively 2 : 2-dibromopropane, but under the influence of added peroxides 1 : 2-dibromopropane is formed. If the reaction temperature is of the order of − 33 to − 40° C., the 1 : 2-dibromopropane is an exclusive product when peroxides are present. W. E. J. B.

547.413.5

240. Mechanism of Addition of Halogens to Ethylenic Linkages. R. A. Ogg. *J.A.C.S.*, 1935, **57**, 2727–2728.—The addition, in solution, of halogens to an ethylenic linkage is suggested to be as follows: $Br^- + RCH=CHR \longrightarrow RCHBr—\overline{C}HR + Br–Br \longrightarrow RCHBr—CBrHR + Br^-$. The addition is thus catalysed by the halide ion. Experimental evidence for this mechanism is reviewed. W. E. J. B.

547.559.5

241. Studies on the Polymethyl Benzenes. XIII. Mercuration. L. I. Smith and F. L. Taylor. *J.A.C.S.*, 1935, **57**, 2370–2372.—This paper describes the mercuration of mesitylene, pseudo-cumene, durene, *iso*-durene, prehnitene and pentamethyl benzene. A number of related mercury–halogen derivatives have also been obtained. W. E. J. B.

547.572

242. Identification of Phenols with 2 : 4-Dinitrochlorobenzene. R. W. Bost and F. Nicholson. *J.A.C.S.*, 1935, **57**, 2368–2369.—2 : 4-Dinitrochlorobenzene reacts with phenols forming highly crystalline stable solids easily purified, and possessing sharp melting points. The procedure is simple, and requires no unusual technique. The authors have prepared the 2 : 4-dinitrophenol ethers in 28 cases, and give the melting points found. W. E. J. B.

547.572

243. Oxidation of Tertiary Hydrocarbons. H. N. Stephens and F. L. Roduta. *J.A.C.S.*, 1935, **57**, 2380–2381.—Six tertiary hydrocarbons of the type, *e.g.* methyl ethyl phenylmethane, have been oxidized at 100–120° C. by bubbling oxygen through them. Reaction always occurred at the α carbon atom to yield, *e.g.* acetophenone. These ketones appear to be primary oxidation products, as alcohols were never detected. The reactions were not inhibited by water. W. E. J. B.

547.672.1 : 542.941

244. Hydrogenation of Anthracene. E. I. Prokopetz and V. N. Khadzhinov. *Khim. Tverd. Topliva*, 1935, **6**, 347–353.—The hydrogenation was carried out in autoclaves

using MoS_2 catalysts at cold hydrogen pressures of 100–120 atm. and various temperatures and with and without recycling. The following products were obtained: 1 : 2 : 3 : 4-tetrahydroanthracene, 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8-octahydroanthracene, perhydroanthracene and a mixture of naphthene hydrocarbons, boiling range 39–150° C.
For. Petr. Tech.

547.313.4

245. Action of Sulphuric Acid on Butanol-2. N. L. Drake and F. P. Veitch. *J.A.C.S.*, 1935, **57**, 2623–2625.—75% sulphuric acid at 80° C. reacts with butanol-2 under pressure in an autoclave to yield 3 : 4-dimethylhexene-2, and di-*sec.*-butyl ether.
W. E. J. B.

662.61 : 547.21

246. Initial Stage of Combustion of Light Liquid Hydrocarbons. K. I. Ivanov and V. K. Savinova. *J. Applied Chem. U.S.S.R.*, 1935, **8**, 64–92.—In the oxidation of toluene, methyl*cyclo*hexane and *n*-heptane, carried out in a specially constructed laboratory apparatus using various concentrations of these hydrocarbons with air, and carrying out the reaction at various temperatures in the vapour phase, a variety of products such as hydrocarbon, acids, aldehydes, ketones and alcohols was obtained. It is concluded that the compounds classified by the increase in ability to yield oxidation products before ignition are: toluene, methyl*cyclo*hexane and *n*-heptane. The oxidation of the two last hydrocarbons proceeds within a wide temperature range with a temperature coefficient of unity, and even lower with methyl*cyclo*hexane. Formation of hydrogen peroxide was observed in the initial oxidation stage of methyl*cyclo*hexane and *n*-heptane, and among the condensation products substances of the type of organic peroxides were separated. The final products of the thermal decomposition depend on the process temperature. The influence of the above phenomena on the detonating properties of the fuel is analysed. Thirty references are given.
For. Petr. Techn.

665.452.2 : 547.217.1

247. Normal Heptane from Shale Oil Gasoline. N. A. Orlov and I. Z. Ivanov. *Khim. Tverd. Topliva*, 1934, **5**, 788–790.—A fraction boiling at 95–102° C. separated from a kukersite gasoline of sp. gr. 0·753 was treated for 20 minutes with 70% acid, 30 minutes with 80% acid, 15 minutes with 90% acid, 30 minutes with 95% acid, then four treatments with 100% acid were given. After washing, neutralizing and drying, the fraction was distilled over sodium and had sp. gr. 0·6997 and n_D 1·3930–18° C. The cut was finally treated with $SbCl_5$ and left for 24 hours, then separated from the precipitate, washed and dried, and redistilled over sodium. The fraction boiling at 98–99° C. was treated again with 100% acid, yielding finally a cut boiling at 97·8–98·5° C., which had characteristics very similar to those of normal heptane. Seven references are given.
For. Petr. Techn.

Analysis and Testing.

531.758

248. Determination of the Specific Gravity of Gases. L. C. Kemp, Jr., J. F. Collins, Jr., and W. E. Kuhn. *Ind. Eng. Chem., Anal.*, 1935, **7** (5), 338–341.—Describes improvements in the effusion method for determining the specific gravity of gases. The apparatus improved was the Edwards specific gravity balance. Particular attention was given to the drilling of the orifice in the plate, and it was found that stainless steel could replace platinum as the construction material. To improve the accuracy, the time of flow was increased by doubling the size of the gas chamber. The effect of plate thickness and orifice diameter on accuracy was studied, and it was indicated that suitable dimensions were: thickness not less than 0·10 mm., diameter 0·24–0·26 mm. Owing to deviations, the effusion method is not recommended to determine accurately the specific gravity of gases in the range above 1·30. Sources of avoidable errors are briefly discussed.
G. R. N.

531.787

249. Precision Oil Gauge. S. Palkin. *Ind. Eng. Chem., Anal.*, 1935, **7** (6), 434–435.—The gauge in effect is a double U-tube manometer in which both oil and mercury

are employed, the latter serving, however, only as a mobile "backing" medium for the oil column. One arm is connected through a stopcock with the lower end of a mercury reservoir; higher on the second arm is another reservoir, which serves as a temporary common reservoir and as a space for the Torricellian vacuum between the oil and mercury when the gauge is in actual operation. The lower end of the oil reservoir is connected through a stopcock to the other U-tube, the longer arm of which is connected with the top of the common reservoir and vacuum space through an inverted U bend. Tubes from the tops of the mercury and oil reservoirs are connected by stopcocks with the pump, the atmosphere and the system to be evacuated. Directions are given for conditioning and reconditioning the gauge in use. Readings on the gauge and on a mercury U-tube manometer indicated the uniform behaviour and precision of the former. G. R. N.

532.13

250. Relation between Redwood Seconds and Kinematic Viscosities. G. Barr. *J.I.P.T.*, 1936, **22**, 1–10.—In accordance with the programme of the I.P.T. Viscosity Panel, an investigation was carried out on the relation between Redwood seconds and kinematic viscosities, and it was found that it cannot be expressed by any single linear formula. G. R. N.

532.13

251. Redwood-Kinematic Relationships at 70° F., 140° F. and 200° F. F. H. Garner, W. E. J. Broom and J. L. Taylor. *J.I.P.T.*, 1936, **22**, 11–22.—An account of experiments on the determination of the Redwood-kinematic relationships at 70° F., 140° F. and 200° F., using suitable oils, together with the equations derived, a conversion table and a nomograph accurate to $\pm$ 0·5%. G. R. N.

532.13

252. Drainage Errors and U-Tube Viscometers. W. E. J. Broom. *J.I.P.T.*, 1936, **22**, 23–26.—A note reviewing the problem of drainage error in the Ostwald type of viscometer, with special reference to the published data of Cannon and Fenske, and indicating the extent of the variation of this error with the time of flow.
G. R. N.

532.13

253. Suspended Level Viscometer. L. Ubbelohde. *J.I.P.T.*, 1936, **22**, 32–41.—Describes the method of using the suspended level viscometer, the thermostatic arrangements, the Hagenbach correction and the surface-tension correction tables being given. G. R. N.

532.13

254. Ball and Bucket Viscometer. E. S. L. Beale and P. Docksey. *J.I.P.T.*, 1936, **22**, 42–48.—Describes an adaptation of the falling sphere viscometer in which the usual arrangement is reversed, *i.e.* the ball is fixed and the cylinder (or bucket) containing the sample is allowed to fall under its own weight. G. R. N.

532.13 : 621.315.615.2

255. Determination of Viscosity of Small Samples of Oil from Oil Impregnated Paper. H. F. Schneider, Jr., and T. A. McConnell. *Ind. Eng. Chem., Anal.*, 1936, **8** (1), 28–29.—It was observed, in the examination of paper and oil-insulated high-voltage cables taken from service and from laboratory simulated service conditions, that the viscosity of the oil in the insulation varied markedly from the centre to the outside of the cable. In order to interpret and evaluate these changes, it was necessary to determine the viscosity on 0·5–2·0 ml. of oil. The Ostwald method and the calibrated pipette were found unsuitable for the viscous oils used, whereas the ball-and-inclined-tube type of viscometer proved satisfactory. The tube used was approx. 5 mm. diam., and the ball was roughly half this diam. (2·37 mm.). The tube was graduated in 4 cm. divisions centrally fixed in a wider tube to form a static water-jacket, which, in turn, was placed in a thermostat at an angle of 60° from the horizontal. Using

a ball weighing 0·0548 gm. and times of 8–300 seconds for a travel of 90 mm., it was found that the range of viscosities which could be covered was about 0·7–25 poises, *i.e.* about 300–10,000 seconds S.U. G. R. N.

532.13 : 665.5

256. Rapid Precision Viscometer. O. Fitzsimons. *Ind. Eng. Chem., Anal.*, 1935, **7** (5), 345–347.—The advent of solvent extraction having brought viscosity index into greater prominence has made it necessary to accurately determine this number. It is shown that a 1% error in efflux time for a 100 V.I. oil gives a much greater error in the V.I. for the Saybolt viscometer than for a capillary tube viscometer giving the same efflux time. Using a capillary of narrower bore and tripling, the efflux time reduces the error of this type of viscometer still further. It is considered that errors in results from the Saybolt viscometer arise from errors in stop watches, electric clocks, variations from tube to tube, and variations in the same viscometer due to differences in type of bath and method of stirring. If the Saybolt instrument is to be used, it should be calibrated with relation to kinematic viscosity. It was found that the Ubbelohde suspended level viscometer fitted in a vapour bath was most convenient, accurate and rapid, and preferable to all other viscometers. By a suitable choice of dimensions, the kinetic energy correction was given by the reciprocal of the efflux time which at 100 seconds or more made this correction negligible. 12 ml. of oil are required for a determination, drainage errors are negligible and the cost is low. Data are given showing the excellent agreement between different operators. G. R. N.

536.421.1

257. Melting-point Apparatus. E. Dowzard and M. J. Russo. *Ind. Eng. Chem., Anal.*, 1936, **8** (1), 74–75.—Describes a portable electrically heated melting-point apparatus of the capillary-tube type, using an air bath, and giving results practically the same as those obtained with the use of a liquid bath. G. R. N.

536.423.1

258. Modification of the Duhring Equation. A. N. Tregubov. *Neft. Khoz.*, 1935, **27** (1), 68–69.—This equation, $K = \frac{T_2 - T_1}{\theta_2 - \theta_1}$, where T_1 and θ_1 are the boiling points of two liquids at one pressure p_1, while T_2 and θ_2 are the corresponding points at a pressure p_2 and K is a constant for the above liquids, is modified in that $K^1 = K - \frac{T - \theta}{\theta - \delta}$, where T_1, θ and δ are the boiling points of three liquids at any and one pressure, and K and K^1 are constants for the above liquids, which do not depend on pressure. The above equation was checked with hexane, heptane and octane with known vapour pressures over a wide range. The corresponding boiling points of these hydrocarbons at R, θ and δ were then plotted for various pressures, and their values were substituted in the above equation for the determination of K^1. The values of K^1 determined in the above manner are very stable, amounting to an average of 0·915 and the deviations are explained by inaccuracies in the drawing. G. R. N.

543.843

259. Determination of Chlorine in Organic Compounds. I. W. M. Malisoff. *Ind. Eng. Chem., Anal.*, 1935, **7** (6), 428.—The organic compound is dissolved in a combustible solvent in various concentrations preferably to produce 0·2–0·3% chlorine, and is burned in the standard sulphur lamp following the precautions officially recommended by the A.S.T.M. The titrations are made with precisely the reagents specified by the method with the same indicator. About 1 gram of solution is burned. The standard calculation may be used and a correction applied—namely, that 1% sulphur is equivalent to 2·216% chlorine. The choice of a hydrocarbon solvent should fall on a petroleum fraction relatively free from sulphur and somewhat lighter than gasoline. The method operates best in solutions less concentrated than 0·5%. Determinations in which smoke or wick crusts are produced should be discarded. G. R. N.

545.723

260. **Determination of CO in Mixtures of Hydrogen and Methane.** G. Meyer and A. Slooff. *Rec. Trav. Chim.*, 1935, **14**, 800.—Carbon monoxide is oxidized to carbon dioxide by iodium pentoxide at 120–130° C. Methane does not react in these circumstances. The iodine formed by reduction is condensed at − 80° C. Carbon dioxide and a part of the methane are condensed with a liquid air-bath. Methane, having a measurable pressure at this temperature, is evacuated with a mercury pump. The solid CO_2 is then evaporated and measured in a calibrated burette. In a second sample of the gas mixture the sum of CO and CH_4 is determined by combusting them to CO_2. Hydrogen also will react with iodine pentoxide, forming iodine and water, the latter giving hydrates with iodium pentoxide. The hydrate will decompose at 180° C. in dry air.

The analysis of synthetic gas mixtures yielded accurate results; neither hydrogen or methane influence the results within the limits of experimental error. P. C. K.

547.42

261. **Potentiometric Determination of Mercaptans.** M. W. Tamele and L. B. Ryland. *Ind. Eng. Chem., Anal.*, 1936, **8** (1), 16–19.—Describes a new procedure for the quantitative determination of mercaptans based on precipitation with silver nitrate. The titration was performed in an alcoholic solution of sodium acetate using sufficient alcohol to dissolve the hydrocarbon sample, and titrating with a solution of silver nitrate in *iso*propyl alcohol. The end-point was determined potentiometrically using a silver electrode as an indicator, thus avoiding an excess of silver nitrate and eliminating the danger of simultaneously precipitating impurities. The method was applicable to coloured solutions, as the selection of the end-point was not dependent on a colour change. This method was free of interference by the hydrocarbon solvent and common impurities. The presence of oxidizing substances such as peroxides had no deleterious effect, whilst the influence of concentration was extremely slight. The maximum discrepancy found in the investigation was about 2%, *i.e.* an error of ± 1·0%. G. R. N.

547.514

262. **Colour Reaction for *cyclo*Pentadiene.** B. N. Afanasiev. *Ind. Eng. Chem., Anal.*, 1936, **8** (1), 15.—Small quantities of *cyclo*pentadiene can be detected as follows: one drop of the liquid to be tested is mixed with 1 c.c. each of chloroform and glacial acetic acid, and then treated cautiously with 2 or 3 drops of concentrated sulphuric acid. As little as 0·1 mgm. of *cyclo*pentadiene gives a distinct violet coloration. Some higher boiling terpenes give a similar coloration, but only with acetic anhydride, chloroform, and sulphuric acid. G. R. N.

662.63/749 : 545.83

263. **Microchemical Analysis of Solid Fuels.** W. R. Kirner. *Ind. Eng. Chem., Anal.*, 1935, **7**, 294–298.—Solid fuels must be subjected to extremely fine grinding and thorough mixing in order to obtain homogeneous and representative micro-samples, care being exercised to minimize induced electrostatic charges. Moisture is determined by drying the sample in a micro-desiccator at a temperature of 110–115° C. for 15 minutes in an atmosphere of nitrogen. The latter is controlled by a Pregl pressure regulator, so that no particles of the sample are blown out of the boat.

The micro-determination of nitrogen, using existing procedures such as Kjeldahl or Dumas methods, is inadequate due to evolution of elementary nitrogen in the gases coming off during digestion. A method, however, is being evolved which will give pure nitrogen only as the gas collected in the azotometer.

Guillemot recommends the benzidine–hydrochloride method for sulphur determination of substances of low sulphur content. The sulphuric acid from the combustion is precipitated as benzidine sulphate.

Using catechol as solvent, the micro-cryoscopic method of Iwanoto for determining molecular weights would appear to be the most accurate.

For the determination of carbon and hydrogen, a compromise between the Pregl Universal and the palladium–asbestos contact fillings for the combustion tube is

suggested for fuels which are known to evolve methane during combustion. Ascarite is used for the absorption of carbon dioxide, and magnesium perchlorate trihydrate is recommended for water absorption.

Ash determination is made direct from the combustion by weighing the residue.

R. E. D.

66.063.2

264. Kauri-Butanol Test for Solvent Power. E. L. Baldeschwieler, W. J. Troeller, and M. D. Morgan. *Ind. Eng. Chem., Anal.*, 1935, **7**, 374–377.—In a study of hydrogenated petroleum solvents it was necessary in the Esso laboratories to investigate the solvency tests for thinners used by the varnish and lacquer industry. Of the four commonly used solvency tests the kauri–butanol test was chosen because experience had shown that it classified petroleum solvents according to their aromatic nature, was sensitive in this respect and was generally included in specifications of petroleum solvents intended as lacquer diluents. Extensive investigation was carried out on this test to overcome some of its objectionable features and to improve its general reproducibility. Most of the sources of error were eliminated by standardization of procedure, but the major source of error was due to non-uniformity of the kauri gum. Using three aromatic hydrocarbons, two naphthenes and a normal paraffin, it was found that standard kauri solutions showed a wide variation in results even when the kauri–butanol value was expressed as "solvent power," *i.e.* the kauri–butanol value multiplied by the ratio of 100 to the benzene equivalent of the gum solution. Various methods of preparing the kauri solutions effected no improvement. Eventually the difficulties were surmounted by using a modified procedure. This consisted of determining the *n*-heptane and benzene equivalents of each standard solution, and plotting these values against the solvent power of these two hydrocarbons as determined with a kauri solution two years earlier than this work, and which gave results regarded at that time as normal. A straight line is then drawn between the two points from which the solvent power corresponding to any kauri–butanol value can be directly read. Graphical and tabulated data are given.

G. R. N.

665.521.2

265. Stability of Gasoline to Light. J. C. Morrell, W. L. Benedict and G. Egloff. *Ind. Eng. Chem.*, 1936, **28**, 122.—It has been found that gasolines sold in exposed glass bowls become hazy and discoloured, and deposit sediment. The factors involved in these photochemical changes were studied. Straight-run, cracked and blended gasolines were exposed to the carbon-arc lamp continuously for 60 minutes in atmospheres of air, oxygen, nitrogen, carbon dioxide and hydrogen. The samples used were: (1) gasolines with no additions, (2) those to which 0·01% of elementary sulphur was added, (3) those to which *n*-propyl disulphide was added in an amount equivalent to 0·10% of sulphur and (4) those to which both sulphur and *n*-propyl sulphide were added.

The results showed that all gasolines in atmospheres of air or oxygen showed colour drops whether sulphur was added or not. Colour and gum formed in the presence of elementary sulphur even in the absence of air, but in the presence of air or oxygen and on exposure to light the formation of colour, haze and gum increased. Haze, peroxides and acids formed only in the presence of air. The straight-run and blended gasolines developed haze, but the cracked gasoline did not. Cracked and blended gasolines formed more gum with sulphur present than the straight-run gasoline. Haze could be removed by filtration, and the colour was greatly improved, but the gum content was unaffected; the haze particles were found to contain sulphur dioxide and trioxide.

W. S. E. C.

665.521.6

266. Determination of the Paraffin Content of Commercial Paraffins. A. M. Ravikovich and V. N. Shile. *J. Applied Chem. U.S.S.R.*, 1935, **8**, 172–176.—Various solvents were tried, and it was found that a mixture of ethyl acetate and alcohol (3 : 1 by volume) is suited best for determining the paraffin-wax content in paraffin and intermediate products. This method, it is claimed, is more accurate than that of Holde, and the separated paraffin is of a higher degree of purity.

For. Petr. Techn.

665.546

267. Analysis of Acid Sludge from Mineral Oil Treatment. E. Holzman and S. Sukarowski. *Ind. Eng. Chem., Anal.*, 1935, **7**, 378–380.—After briefly discussing the methods previously employed in the analysis of acid sludge, the authors describe a method in general applicable to all kinds of acid sludge obtained in the treatment of paraffin and naphthene base oils with sulphuric acid of various concentrations. About 20 gm. sludge are made alkaline with NaOH, 50 ml. benzene and 20 ml. alcohol are then added, and the mixture is refluxed, then poured into a separating funnel. The upper benzene layer is separated, suitably washed, filtered from insoluble matter and distilled to remove this solvent, leaving a mineral oil residue. The lower aqueous layer is acidified with concentrated HCl, and the sulphonic acids are extracted with amyl alcohol. The extract is water washed, then dried by filtration and the amyl alcohol is removed by distillation from an oil bath at 100° C., the residue of sulphonic acids being dried *in vacuo* at 115° C. The remaining aqueous acid layer is then made up to a suitable titer, and the free sulphuric acid estimated as barium sulphate.

The authors then describe a method of determining the proportion of α and γ-acids of Pilat's classification in the sulphonic acids separated by the above procedure, which involves the use of amyl alcohol and lime water. Typical analyses are given.

G. R. N.

Refining and Refinery Plant.

66.042.7

268. Chart for Computation of Flue Gas Losses. W. F. Schaphorst. *Oil & Gas J.*, 12.12.35, **34** (30), 26.—A simple nomographic chart is reproduced which enables the flue gas losses to be determined, taking into account the CO_2 losses as well as those due to high flue gas temperature. Examples are worked out showing the application of the chart.

C. L. G.

66.067.75 661.183

269. Natural and Activated Decolorizing Earths. C. L. Alexanian. *Ann. des Comb. Liq.*, 1935, **10**, 1097–1127.—The author discusses the types of natural decolorizing earths (fuller's earths) which are known and the localities in which they are found in England, France, Germany, Japan and the U.S.A. In the latter country are found floridine, used as extracted, and bentonite, used after a chemical treatment. The German activated earths, prepared from Bavarian earths by chemical means, are also discussed. Analytical data of the various earths are given, but it is pointed out that such data do not indicate the usefulness of the earths. In general, carbonates must be less than 3% at the time of activation, whilst the water content and its manner of combination are important factors. A brief review of the Freundlich adsorption isotherm is given as applied to the action of earths, and the specific nature of the decolorizing process is stressed. The preparation of both natural earths (simple drying or heating) and activated earths are dealt with at some length. The latter type may be acid treated, or dehydrated (*e.g.* Bauxite). The author next reviews the use of earths for decolorization purposes and their regeneration, and describes at length suitable laboratory methods of evaluation. An excellent bibliography is appended.

W. E. J. B.

665.521

270. Combination Distillation and Cracking Unit. N. Williams. *Oil & Gas J.*, 23.1.36, **34** (36), 26.—A description is given of a combination crude distillation and cracking unit under erection at a Beaumont (Texas) refinery. The plant, which is the largest of its type ever constructed, has a capacity of 32,000 brl./day, and embodies a number of unusual processing, operating and constructional features.

The crude after heat-exchange is preheated to 650° F. and passed to a fractionation unit, where light naphtha, heavy naphtha, range oil and gas oil are taken off. The gas oil is cracked, the furnace used being a section of that used for the crude oil. It consists of a double combustion and radiant section, with a common convection bank between the two combustion zones. The residue from the first tower passes to a separate viscosity breaker furnace, and thence to a combination evaporator and bubble tower.

A safety measure taken is the availability of both motor- and steam-turbine drives pumps for the furnace feed, which handle 75% and 25% of the feed, respectively. In the case of failure of the electric supply, the turbines will maintain 50% of the feed circulation until the furnaces are shut down or the power is restored. Other features include the use of the hot flue gases to preheat the combustion air and the use of enclosed tube type condensers and heaters. All phases of the plant are automatically controlled from a centralized room above the pump-house. C. L. G.

621.187.1 665.54

271. Power in Refinery Saved by Feed Water Heater. W. F. Schaphorst. *Petr. Eng.*, Nov. 1935, **7** (2), 54.—The saving in boiler h.p. by using a high-grade feed-water heater can be calculated from a nomograph (reproduced). An example is given of a saving of 9 boiler h.p. for a consumption of 2000 lb. water per hour by using a feed-water heater, which raises the temperature to 150° F. An additional saving, often amounting to 25%, is due to keeping scale out of the boiler. C. L. G.

66.046.3

272. Economics Involved in the Design of Recovery Equipment for Refineries. N. T. Buddine. *Oil & Gas J.*, 2.1.36, **34** (33), 34.—A discussion is presented of a method of determining the amount of waste heat which can be economically used for heat exchange with the incoming crudes. Estimates should be made of the cost of direct firing and of cooling the products without heat-exchange and of the cost per sq. ft. per year of heat-exchange surface. By dividing the third item into the sum of the first two, the minimum heat recovery duty which each square foot of heat-exchange and surface must perform to be a cheaper source than the furnace, is obtained. Since the duty of each square foot of surface added to a heat exchanger is less than that of the preceding one, surface may be added to each exchanger until the duty of the last square foot has fallen to this value.

The method of making the estimate and factors to be allowed for are discussed in detail and the principles involved illustrated by examples. An appendix gives the method of derivation of the equation for determining the minimum economical heat recovery per sq. ft. of exchange surface. C. L. G.

66.046.2

273. Liquid to Liquid Heat-Exchangers. R. H. Turner. *Petr. Eng.*, Dec. 1935, **7** (3), 59.—The theory of liquid–liquid heat exchange is discussed and applied to the design and selection of heat exchangers, various typical problems involved being explained. Transmission of heat from a gasoline in the shell of a heat-exchanger to the cooling water passing through a single tube consists of: convection through the gasoline to a film on the outside of the tubes, conduction through the gasoline film through the metal and through the water film, and finally convection through the water. The effect of foreign matter, *e.g.* coke from tar, etc., in reducing the heat conducted is thus obvious. When cooling tar, it is usually placed in the shell, as a greater rate of heat transfer can be attained by a closer sparing of the shell baffles. By increasing the passes within the tubes the necessary velocity is given to the greater relative quantity of charging stock. The increased heat transfer by placing the tar in the still is, however, out-weighed by the extreme difficulty in cleaning them after service. Placing the tar within tubes of sufficient size and short length to permit of easy cleaning would be preferable, although the first cost is materially higher.

It is emphasized that the performance from a unit cannot be indicated from the surface dimensions, but depends also on the number of passes and the spacing of the shell baffles, this being illustrated from the calculated surface area required under definite condition in two heat-exchangers, one with baffle spacing of 4-in. centres and 2 tube passes, and the other with baffle spacing 1 in. and 4 tube passes. In the latter case the surface required is only 46·2% of that required under the former conditions.

Another important factor in the selection of heat-exchangers is "temperature crossing," *i.e.* parts of the exchanger being rendered ineffective owing to the cooling medium becoming hotter than the liquid to be cooled.

The ratio of the apparent L.M.T.D. (log mean temperature difference) to the true

L.M.T.D. (*i.e.* under true counter-current flow conditions), is determinable from a chart (reproduced), which gives the required factor for 1 to 4 heat-exchangers with multipass arrangements. The main types of baffles used to increase turbulence include the orifice, vane flow, oversize tube hole drilled, disc and doughnut and half-moon types.

Formulæ are given and explained, enabling the velocity through the shell and through the tubes to be calculated.

The true temperatures of the liquid films inside and outside the tube are very difficult to determine, but are very important in view of their effect on the rate of flow of the liquids. From an extensive series of laboratory and field tests, formulæ for their determination have been worked out.

The film temperature of the medium being cooled is taken as the average temperature (*i.e.* inlet–outlet temperature) minus $\frac{1}{4}$ of the L.M.T.D., and that of the medium being heated, its average temperature plus $\frac{1}{4}$ of the L.M.T.D. On this basis calculations are made of the heat-exchanger surface required for a definite series of conditions. Further calculations are made of the pressure drop in the shell and tubes.

C. L. G.

665.54 : 608.3

274. Patents on Refinery Plant. E. T. Pummill. U.S.P. 2,023,545–2,023,546, 10.12.35. Apparatus for treatment of liquids of different specific gravity, *e.g.* acid treatment of oil. It consists of several units in which the oil to be treated is contacted with a mixture of acid and acid sludge which is in excess of the volume of oil. A settled oil is withdrawn from each unit and passed to a further unit and contacted with sludge–acid mixture of greater strength. A sludge–acid mixture is withdrawn from each unit and passed to the next in series, but counter-current to the oil sequence. Stronger acid–sludge mixture is supplied to each unit from the unit prior in the series.

665.54 : 608.3

P. C Keith, Jr. U.S.P. 2,025,667, 24.12.35. A method is described for increasing the heat-reflecting capacity of selected parts of a tubular heating coil exposed to radiant heat. The selected parts are painted with a white pigment capable of withstanding normal furnace conditions. The paint is fixed on the surface in a relatively thin layer.

W. S. E. C.

Cracking.

665.53

275. Kinetics of Vapour-Phase Cracking. A. I. Dintzes, M. P. Eshevskaya and T. I. Klabina. *Khim. Tverd. Topliva*, 1935, **6**, 428–438.—In a very superficial decomposition (10–15%) the velocity of the cracking reaction is practically independent of the degree of cracking or of the duration of the reaction, and it is in satisfactory agreement with the law of molecular reactions. Individual narrow cuts of straight-run Grozny and Baku petroleum of boiling range 100–270° C. are characterized by practically identical energy of activation of the cracking reaction, which amounts to 50,000 $\pm$ 4000 cal. per gm.-mol. The composition of the cracked products depends but little on the reaction temperature within 500–600° C., whilst the amount of unsaturates increases slightly when exceeding this temperature. The statement by Pease on the fall of activation energy with the increase in hydrocarbon molecules is contradicted. Another statement by Pease, *i.e.* the ratio of the energy of activation to log A of the Arrhenius equation is a constant, is also questioned. For the products investigated these values vary from 4·16 to 4·94.

For. Petr. Techn.

665.53 : 608.3

276. Patents on Cracking. N. S. Olsen. U.S.P. 2,023,205, 3.12.35. Oil is mixed with finely-divided hydrogenated catalyst and then heated to cracking temperature under pressure. The heated mixture is atomized with hydrogen, and, while atomized, heated to 800–1050° F. at a pressure in excess of 1000 lb. per sq. in.

G. Egloff. U.S.P. 2,022,803, 3.12.35. Heavy oil is distilled into a light and a heavy fraction. A portion of the latter is cracked in the liquid phase and another portion

diverted from the heating stage and introduced to the light cut prior to its cracking in the vapour phase. The two cracked products are blended and distilled.

L. A. Mekler. U.S.P. 2,022,810, 3.12.35. Primary reflux from cracked vapours is mixed with charge stock and the mixture cracked in the liquid phase. A secondary reflux is separately cracked in the vapour phase and the two cracked products are blended and distilled.

H. R. Snow. U.S.P. 2,022,985, 3.12.35. A device for the removal of carbon or coke from the outlet of the reaction zone of cracking plants.

C. B. Buerger. U.S.P. 2,023,063, 3.12.35. A sectional heater for cracking processes in which oil is heated to cracking temperature in one zone, using the hottest furnace gases. The hot oil is then passed to less highly heated zones of the furnace counter-current to the furnace gases in order to maintain cracking temperature.

G. O. Shefstead. U.S.P. 2,023,619, 10.12.35. A combined topping and cracking process in which the cracked residue is distilled to yield a distillate cracking stock and reflux from the cracking plant is used as an aid to the distillation of the crude oil.

R. F. Trow. U.S.P. 2,023,775, 10.12.35. A process involving the combination of a liquid phase, a vapour phase and a low liquid level cracking procedure, the apparatus involved being of the tube and drum type.

M. Levine. U.S.P. 2,024,828, 17.12.35. Apparatus for vapour-phase cracking including an improved form of expansion zone.

L. de Florez. U.S.P. 2,024,996, 17.12.35. A process in which the charge stock is discharged into a distillation zone receiving hot cracked vapours. Gasoline, clean recycle stock and residue are removed from the zone, and the residue is coked in a coking zone in contact with the cracked recycle stock.

C. P. Dubbs. U.S.P. 2,025,500, 24.12.35. A process in which coke formation is reduced by control of heating after cracking temperature is reached.

C. P. Dubbs. U.S.P. 2,025,501, 24.12.35. Incondensable cracked gases are heated by indirect heat-exchange with cracked vapours prior to their dephlegmation and then mixed with reflux condensate in order to reboil the latter. The reflux is thus combined with any condensate formed from the gases.

J. D. Seguy. U.S.P. 2,025,532, 24.12.35. Uncondensed cracked products are liquefied in order to remove high-boiling components which are re-cracked under intense conditions.

E. W. Isom. U.S.P. 2,026,231, 31.12.35. Improvements in the operation of externally heated tubular single-pass cracking stills or of cracking still systems in which externally heated tubular single-pass heaters are employed.

D. P. Bailey. U.S.P., 2,026,505, 31.12.35. Charge stock is subjected to moderate cracking conditions and the vapours are passed to other reaction vessels, being finally dephlegmated to produce a motor fuel and a clean gas oil condensate. The latter is cracked and the product contacted with fresh charge oil. W. H. T.

Hydrogenation.

66.094.1 : 541.128

277. Properties of Molybdenum Sulphide Catalysts. E. I. Prokopetz and I. I. Eru. *Khim. Tverd. Topliva*, 1935, **6**, 67–73.—The following phenomena were observed with molybdenum sulphide catalysts used in hydrogenation. MoS_2 is easily decomposed at elevated temperatures in contact with the metallic walls of reaction vessels, although on introducing elementary S the activity of MoS_2 or MoS_3 can be temporarily restored. The addition of a Ni oxide to MoS_2 catalyst retards the poisoning of the mixture by prolonging the activity of the Ni oxide. H_2S could not be traced in gases obtained in hydrogenation, but a cooled hydrogenated gas had its typical odour. A detailed description of the experiments is given. For. Petr. Techn.

66.094.1 : 547.314.2

278. Production of Gasoline from Acetylene by Catalytic Hydrogenation. B. Kwal. *Chim. Ind.*, 1935, **34**, 773.—The authors used a mixed catalyst, consisting of active coal and cuprous oxide. It was known that active coal has a hydrogenating power under cracking conditions. Cuprous oxide above 250° C. accelerates cracking.

A series of experiments under comparable conditions showed the difference of action of active coal only and of the mixed catalyst. Operating at 725° C. with a

reaction time of 175 min. a yield of 52% by weight of liquid hydrocarbons was obtained; however, an abundant deposition of coal had taken place, due to the poor hydrogen content of acetylene. Therefore in the next experiment hydrogen was added, raising the yield of liquid hydrocarbons to 70%. The residual gases contained ethane, ethylene and hydrogen but no acetylene. There was no coal separated. P. C. K.

66.094.1 : 668.737.1

279. Hydrogenation of the Anthracene Fraction of Coal Tar. F. E. Shtraler and V. M. Moisenko. *For. Petr. Techn.*, 1935, **3** (9), 435.—Using molybdenum sulphide and its composite catalysts at 300 atm. hydrogen pressure and at 475° C., liquid and solid anthracene fractions in a Hœfer autoclave yielded 22% light aromatic hydrocarbons after 2 hours, 29% after 4 hours and 54% after three recyclings, no coke being formed. MoS_2 was the best catalyst, and coke-oven gas could be used, although five recycles were necessary. The gas from the reaction could be used again. A detailed description of the products and the experiments is given. G. R. N.

Polymerization.

661.183 : 549.6

280. Polymerizing and Adsorptive Properties of Silicates. V. M. Slobodin. *For. Petr. Techn.*, 1935, **3**, 427.—Silica gel, fuller's earth and several Russian silicates were investigated using *iso*butylene for polymerization experiments and gasoline, kerosine, and gas oil for adsorption tests. Maximum activation temperature for polymerization was at 300–325° C., whilst activation below 200° C. and above 600° C. rendered the material inert in this respect. The ability of the silicates to effect polymerization depended on the inner structural changes caused by heating. Silica gel did not cause polymerization. Silicates having a high polymerizing power had also a high adsorption ability. G. R. N.

66.095.26 : 547.313

281. Polymerization. H. I. Waterman and C. v. Vlodrop. *Chim. Ind.*, 1935, **34**, 1036.—Generally all polymerizations of olefines of low mol. weight by means of aluminium chloride yield cyclic compounds, even at — 80° C.

Exceptions are found in the case of *iso*butene and hexadecene. Polymerizing *cyclo*hexene cyclic compounds only are formed. The average structure of the polymers, analysed by means of physical constants according to the system used in the authors' laboratory, is plotted in three graphs as a function of the molecular weight. P. C. K.

66.095.26 : 547.313

282. Thermal Process for Polymerizing Olefin-Bearing Gases. M. B. Cooke, H. R. Swanson and C. R. Wagner. *Oil & Gas J.*, 14.11.35, **34** (26), 57; *Refiner*, 1935, **14**, 497.—The trend of refinery cracking is from low temperature to higher temperatures, with a corresponding decrease in pressure. This results in an increasing gas yield of high unsaturation which is ideal charging stock for polymerization plants. The gases may be handled in two ways: (*a*) compressed and charged as compressed gases to the polymerization coil; (*b*) treated either by absorption or by fractionation under pressure to remove the hydrocarbons of lower mol. wt. and concentrate the more active unsaturates which are charged under pressure in the liquid state.

Operating by the first method, the gases are compressed to 600–800 lb. pressure and heated to 900–1000° F. in a pipe-coil heater. The gases are soaked in a reaction chamber or coil, which is cooled to absorb the exothermic heat of the reaction, and then chilled by injection of cold gas or oil. The reaction is checked at 60–70% conversion necessitating a re-circulation ratio of about 1·5. The mixture is then fractionated and the liquid product stabilized. The yield of gasoline is about 3·25–4·5 gals. per 1000 cu. ft. of gas, or about 28% conversion. The gasoline contains about 25% aromatics, is highly volatile and has an octane number of 78–80 A.S.T.M. and a blending value of 96.

The second method is more advantageous from the point of view of economy of power usage and investment cost and control of operations. The amount of ethylene in the charging stock is relatively small, but the yields are only slightly lower, since ethylene polymerizes too far if the reaction is carried out at the proper temperature for propylene–

butylene reaction, giving rise to tar formation. The yield per 1000 cu. ft. of gas charged is about 8·8 gals.

Alternatively, the plant may be operated at temperatures of 1150–1300° F. and reaction coil pressures of 50–75 lb., using either method of charging. The yields under these conditions seem to be somewhat lower, but this is more than compensated for by the higher anti-knock value of the gasoline obtained, which is 85–105 octane number A.S.T.M., and the blending octane value is 105–125. The polymer produced is almost entirely aromatic, and the volatility is low.

It is estimated that about 7800 brl. of gasoline a day could be produced by these means from the gas produced by the 90 vapour-phase cracking plants operating in the U.S.A. This type of gas represents the most suitable material for polymerization. The gases from liquid-phase cracking plants and also natural gas can, however, be treated by a combination of pyrolysis and polymerization. Flow sheets of the two methods of polymerization and of a combination pyrolysis and polymerization plant are provided. The differences between the properties of the low-temperature–high-pressure and those of the high-temperature–low-pressure polymerized gasolines provide the necessary flexibility in choice of plant to be installed. It is estimated that polymer gasoline can be produced at a cost not exceeding 5 cents per gal. at the present time, assuming the gas-charging stock to have a value not exceeding that of heavy fuel. The method provides the cheapest source of aromatics so far made available. Lists of polymerization patents and of the bibliography of the subject are appended.

R. A. E.

Synthesis.

665.58

283. Gasoline Synthesis from Carbon Monoxide and Hydrogen at Atmospheric Pressure. I. Rapoport, A. Byudov, L. Shevyakova, and E. Frantzuz. *Khim. Tverd. Topliva*, 1935, **6**, 221–235.—The following catalysts were investigated, Ni–Mn, Ni–Mn–Al, Ni–Mn–Cu, Ni–Th–Hg, Co–Th, Co–Mn, the most active being Co–Th, Co–Mn, Ni–Mn–Cr and Ni–Mn–Al. The method of preparation is of great importance with respect to their activity. Thus a precipitation of hydroxides and the carbonate of the metal with K_2CO_3 from a mixture of nitrate solutions yields less active catalysts, whilst a precipitation with a preliminary variation of the metal salt concentration within certain limits yields active and stable catalysts. The reaction temperature is of great importance for the life of the catalyst. A high temperature yields less solid hydrocarbons which are deposited on the catalyst, and it promotes the formation of gaseous (low-boiling) hydrocarbons. The best temperature is that where 7–10% methane is formed. The reaction favours the formation of liquid hydrocarbons with a low proportion of solid ones. The presence of small amounts of ammonia in the reaction gas increases the yield of gasoline, this being particularly the case with catalysts precipitated with fuller's earth. Asbestos carrier yields the best catalysts. Twelve references are given. For. Petr. Techn.

662.754.3

284. Synthesis of Higher Alcohols from Water Gas. E. M. Bocharova, B. N. Dolgov and Z. M. Prokhorova. *Khim. Tverd. Topliva*, 1934, **5**, 559–568.—The experiments cover the investigation of syntheses under pressure from CO and H_2 mixtures in the presence of Zn aluminates, mixtures of ZnO and PbO zincates and alkaline vanadates. Best results were obtained with $4ZnO,V_2O_5$,KOH and particularly with $8ZnO,V_2O_5$,KOH. The latter yields under the most favourable conditions, *i.e.* at 425° C. and 220 atm., a condensate containing 35% of an oil layer with 220–260 ml. of oil per cubic metre of gas. A lowering of the amount of KOH and V_2O_5 and an increase of ZnO lowers the yield of oil. The gas mixture should have a ratio of $CO/H_2 = 1$, a higher content of hydrogen lowering the yield of oil. A preliminary analysis of the condensate showed the presence of 32·5% of alcohols higher than methyl alcohol. For. Petr. Techn.

Motor Fuels.

662.753.21

285. New Treating Process for Motor Benzole. V. Voorhees. *Oil & Gas J.*, 12.12.36, **34** (30), 36.—Until recently the "acid wash test" was generally applied to motor

benzole, necessitating vigorous refining treatment and involving the loss of 5–15% of the fuel. The N.B.A. has shown that the only value of acid treatment is to obtain stability against formation of gum, and this can be achieved more economically by the use of anti-oxidants.

Reference is made to the work of Hoffert and Claxton in the development of this process. The properties required of an anti-oxidant are: effectiveness, water insolubility and colour stability. Of the materials available, benzylaminophenol is probably the most suitable. The commercial grade is a light brown, finely ground powder, m. p. 84–90° C., and at 25° C. its solubility in methanol is approx. 60%, in ethanol (95%) approx. 65%, in water 0·06% and in benzole 1·35%. The amount required is generally 0·001–0·005%, and hence it has substantially no effect on the colour and other characteristics of the gasolines. An oily residue on evaporation of the benzole may be caused when cresol is used, owing to the larger amount required.

It is usually necessary to subject motor benzole to some degree of refining before adding anti-oxidant, in order to improve colour and odour. When treatment with dilute acid, followed by caustic wash and distillation, is utilized, the inhibitor may be added periodically either in solid form or in concentrated solution in methanol or ethanol to the distillate stream, and the batch circulated in the receiver or tank when completed. Anti-oxidant can also be employed when other methods of treatment, such as vapour-phase clay, ferric sulphate or silica gel, are utilized. To obtain best results anti-oxidant should be added to the benzole soon after final distillation, and the presence of alkali and water should be avoided. When the benzole contains an unduly high percentage of sulphur, fractional distillation or fractional acid treatment may be utilized to reduce the sulphur content. Specifications of a U.S. producer and of the N.B.A. are quoted. The former specifies a gum content of less than 10 mgms. per 100 ml. by the glass bomb test after 400 min. This has been shown by extensive tests on gasolines to indicate that the benzole will remain substantially free from gum after 1 year of ordinary storage. The glass bomb test is carried out by introducing 100 ml. of sample into a specially constructed 1-litre flask previously filled with oxygen and subsequently tightly stoppered and placed in a steam bath at 210° F. for 400 min. Gum is then estimated by A.S.T.M. method A.

Results of tests on samples are correlated with gum content after ageing in glass bottles kept in the dark at 85–90° F. for periods up to 10 months. The colour of the benzole treated with dilute acid and anti-oxidant is not so good as that of the benzole treated with strong acid, but when the benzole is used in blends with gasoline, this is not so important, especially when the marketed product is dyed. The colour stability is good. The savings effected by the U.S. producer mentioned, when changing over from strong acid to anti-oxidant treatment, amounted to 75 cents per 100 gals. treated.

R. A. E.

665.442

286. Suitability of Lignite Oils as Motor Fuel. R. Heinze. *Petr. Z.*, 6.11.35, **31** (44), *Motorenbetrieb*, *5*; *Oil & Gas J.*, 30.1.36, **34** (37), 54.—The production and utilization of lignite oil in Germany, and in particular the testing of lignite diesel oil are discussed.

The production of lignite-shale oils in 1934 was 225,000 tonnes of tar and 25,000 tonnes of light oil, of which 141,000 tonnes were worked up in tar distilleries, 85,000 tonnes were hydrogenated at Leuna and 24,000 tonnes used for making oil gas by the Federal Railways, etc. The 141,000 tonnes worked up in distilleries, together with 30,000 tonnes of generator and imported shale tar, produced 18,400 tonnes of gasoline and tractor fuel, 35,700 tonnes of diesel fuel oil, 67,400 tonnes fuel oil and 1500 tonnes of special oils. The lignite gasoline has an octane value of 60–70 and a peculiar odour.

The use of the cetene value test for determining the ignitability of diesel fuel and the application of the specific parachor for this purpose is discussed. C. L. G.

665.521.2

287. Refining Cracked Gasoline. B. K. Tarasov and V. V. Rudenko. *Groz Neft.*, 1934, **4** (9), 34–37.—The following conclusions were derived: (1) the application of gravel for a rapid separation of the acid sludge from the pressure distillate followed by a dry neutralization yields high-grade gasolines, although a higher stability in storage

is attained when introducing anti-oxidants. (2) Samples stable in storage are obtained from gasoline with an E.P. of 225° C., which received a preliminary treatment of the oxidizers in the acid treatment. The high content of potential gums (present in this gasoline) indicates that probably oxygen-containing compounds are formed through the oxidizers. These compounds cannot be removed by acid, and are stable at ordinary temperature, although they induce gum formation on storage. (3) Treatment with greater proportions of acid yield gasoline low in potential gums, the consumption of acid depending on the character of the pressure distillate. (4) Heavy gasolines are more stable than the lighter ones after a doctor treatment, provided an excess of elementary sulphur was absent. This is due to the stabilizing effect of the high-boiling fractions. (5) The high-boiling fractions (above 150° C.) contain natural stabilizers, which are removed in the refining. By adding these fractions to the light gasoline the latter is stabilized, although it then has an unsatisfactory colour.

For. Petr. Techn.

665.521.2 : 66.074.37

288. Desulphurizing Gasoline by Means of Ozone. A. V. Kersanov and V. N. Suslina. *For. Petr. Tech.*, 1935, **3** (10), 463–490.—The following conclusions are made :

(1) In the ozonization of gasoline from Chusov crude oil a product free of sulphur or containing insignificant amounts of sulphur is easily obtained.

(2) Best results are obtained when distilling the ozonized gasoline with steam in the presence of lime.

(3) The sulphur compounds of Chusov gasoline, when ozonized, are converted in part into sulphuric acid and in part into acidic non-volatile products and partly into neutral non-volatile products.

(4) The ozonization is carried out best at — 20° C.

(5) Simultaneously with the desulphurization there is a lowering of the iodine number, lowering of the content of naphthenes, and an increase in the content of paraffins and aromatics.

(6) According to the desulphurization curves of the gasoline, when applying ozonization it is possible that the gasoline contains three types of sulphur compounds reacting with the ozone at various velocities.

(7) It is most probable that the sulphur compounds of Chusov gasoline are derivatives of naphthenes and partly of aromatics.

(8) Judging by the curves characterizing changes in the properties of the mixture under the influence of ozonization it is possible to obtain an approximate picture of the number and the type of substances present in the mixture that react with ozone.

G. R. N.

665.521.7 665.521.1

289. Coking Petroleum Residues Results in Large Recovery of Anti-Knock Fuel. D. Glynn-Jones. *Oil & Gas J.*, 26.12.36, **34** (32), 113.—A coking plant which works continuously has been invented by A. Knudsen, and is now in the initial operating stages. The construction of the full-scale plant differs from that of the experimental plant which has been previously described, the whole process including the coke-cleaning devices, working automatically.

The plant consists essentially of an endless chain of metal containers propelled by two driving wheels, one at either end of the plant. The containers move through an externally heated coking chamber constructed of heat-resisting alloy. The buckets enter and leave the chamber through throats of reduced area which virtually seal off the chamber from the rest of the plant. The interior is kept under a very slight vacuum, and the vapours pass up through vapour mains to the fractionating tower. After passing through the chamber, the containers return in an inverted position to the filling end of the plant, being cleaned of their coke by an automatically operating device immediately prior to further injection of material for coking. The whole plant is enclosed to conserve heat, and a small amount of steam is opened to the two ends of the plant in order to preclude leakage of air through the throats under the influence of the slight vacuum in the chamber.

In the unit described an asphalt of softening point (Ring and Ball) of about 60° C. is used as feed. This is obtained as bottoms from a vacuum tower into which high

viscosity residue from a Kellogg viscosity-breaking unit flows. It is maintained and injected at a temperature of 360° C. The vapours are fractionated in a bubble tower and coke removed from the containers travels to storage by a system of belt conveyors and elevators.

Preliminary results indicate yields of 5–10% of gasoline of 210° C. E.P.; 45–55% of gas oil, the light oil having a viscosity S.U. at 38° C. of 42 secs. and the heavy oil a viscosity S.U. at 50° C. of 310 secs.; 20–30% of coke and 10–15% loss and gas. The coke analysis on a dry basis shows about 7% volatile matter, 91·8% fixed carbon, 1·25% ash, 0·26% sulphur, calorific value 15,229 B.Th.U. per lb. The content of volatiles can easily be controlled by changing the temperature inside the coking chamber or by changing the speed of the containers. R. A. E.

665.521.2 : 66.074.37 : 608.3

290. Patents on Motor Spirit. A. F. Endres. U.S.P. 2,022,847, 3.12.35. Sweetened light naphtha is prepared by separating a light fraction from raw naphtha using a debutanizing process. The product is freed from gaseous hydrocarbons, sweetened by an alkaline solution of sodium plumbite and finally stabilized.

665.521.2 : 66.074.37 : 608.3

W. A. Schulze and L. V. Chaney. U.S.P. 2,022,942, 3.12.35. Oil is treated with alkaline hypochlorite solution, whereby sulphur compounds with oxidizing properties are formed in the oil. The solution is separated and mercaptan added to the oil in a quantity equivalent to the oxidizing sulphur compounds, whereby the latter are converted to disulphides.

665.521.2 : 608.3

W. M. Stratford. U.S.P. 2,024,117, 10.12.35. Cracked motor fuel is refined by solvent extraction, using a mixture of furfural and water in such proportions that a 10% extract containing gum-forming constituents and sulphur compounds is removed.

665.521.2 : 608.3

J. T. Rutherford. U.S.P. 2,024,476, 17.12.35. Extraction of naphtha with liquid sulphur dioxide in order to obtain unsaturated and aromatic constituents.

665.521.2 : 608.3

R. F. Davis. U.S.P. 2,024,681, 17.12.35. Refining distillates containing unsaturated and sulphur compounds by treatment with sulphur dioxide in the presence of aluminium chloride.

665.521.2 : 608.3

J. F. M. Taylor. U.S.P. 2,025,255, 24.12.35. Cracked gasoline is refined by a distillation process in which the sulphur compounds are segregated into certain fractions.

665.521.2 : 608.3

J. C. Black. U.S.P. 2,025,409, 24.12.35. Crude gasoline is distilled into a light and a heavy fraction. The former is stabilized, the latter is refined and the two products finally blended.

665.521.2 : 66.074 : 608.3

B. Mead. U.S.P. 2,025,766, 31.12.35. Distillation of acid-treated oil, in which an oil-soluble soap is added in order to neutralize any acid-material developed during distillation.

665.546 : 608.3

G. W. J. Bradley. U.S.P. 2,026,456, 31.12.35. Recovery of sulphuric acid from acid tar by introducing the latter in a thin stream into actively boiling water.

W. H. T.

Lubricants and Lubrication.

621.315.615.2

291. Influence of Thin Metal Layers on the Deterioration of Technical Insulating Oils. P. J. Haringhuizen and D. A. Was. Tech. Publ. Intern. Tin Res. Dev. Council, Ser. A, No. 29, 1935; *Proc. K. Akad. Wetensch. Amsterdam*, 1935, **38**, 1002.—A study of the influence of metals on the deterioration of insulating oils. From the viewpoint of both sludge formation and acidity increase, copper has the greatest influence, lead less, and tin the least. Tin may act as an anti-oxidant.

The character of the catalysis has also been investigated. G. S.

665.521.5

292. Acid-treating Lubricating Oils to Improve Viscosity Index. *Petr. Eng.*, Dec. 1935, **7** (3), 56.—The results are given of heavy laboratory treatment of dewaxed Mid-Continent oils in order to improve the viscosity indices. The oils (two distillates and a residuum of viscosity at 100° F. of 471, 1590 and 4600 secs. respectively) after dewaxing were treated with 75 lb./brl. of 98% H_2SO_4, using air agitation, settled and contacted with Filtrolclay for 1 hour. Treatment losses were very high:—20·6%, 31·5% and 48% respectively, but viscosity indices were improved from 76, 70, 84 respectively to 102, 98 and 101. Although the treatment is very expensive, it obviates the necessity of erecting a solvent extraction plant, the existing refining plant equipment being utilized. The oils obtained are believed to be on a par with those obtained by solvent extraction. C. L. G.

665.521.5 : 66.061.5

293. Refining of Mineral Oils by Selective Solvents. M. Gheorghiu. *Mon. Petr. Roum.*, 1935, **36**, 1779–1781.—The advantages of solvent refining for producing high-class lubricating oils are discussed. C. C.

621.892.25

294. Chassis Lubricating Greases. R. R. Matthews. *Oil & Gas J.*, 14.11.35, **34** (26), 65; *Refiner*, 1935, **14**, 548.—It is estimated that the consumption of greases for chassis lubrication was over 200 million lb. in 1934 in U.S.A. However, it is evident that in many cases lubrication is still inefficient, and there is need for standardization of chassis parts requiring lubrication and changes which would mean better lubrication. This would encourage standardization of greases and reduction in the number of grades required. Developments which have taken place in the methods of lubricating shackles, wheel bearings, steering gears, universal joints and water pumps are described. Semi-fluid lubricants have been popularized by the development of Tryon and threaded shackles which require a grease of greater fluidity than was previously necessary. Aluminium greases are gaining favour on account of their appearance, and the fact that they do not deteriorate or harden with age. They are useful for purposes other than chassis lubrication, and have as good a resistance to emulsification with water as calcium base greases. The use of greases containing oils of too low a viscosity should be avoided.

Wheel-bearing greases may be calcium, soda or mixed base types, and the ideal combination would embody good resistance to softening by heat, a smooth texture and consistency—causing it to follow closely the bearing with a complete cushioning effect. Greatest durability would probably be obtained when worked and unworked penetrations are fairly close together. Mild E.P. properties are probably desirable, especially for trucks.

Universal joints require a special grease possessing cohesion and adhesion. Combination wheel-bearing and universal joint greases are sold, but do not necessarily possess the special qualities required for universal joints. A special sodium-base grease having a very long fibre is manufactured for this purpose. Water-pump greases are usually calcium base type to resist emulsification with water, and a hard consistency is desirable so as to impart resistance to softening by heat.

Compositions and specifications of satisfactory greases for the above purposes are given. Metal-covered springs require a graphite grease having worked penetration of 270–290 A.S.T.M. and the most efficient contain 40–45% of graphite.

Improvements which have taken place in the manufacture and handling of lubricating greases are described. R. A. E.

665.521.5 : 66.061.5 : 547.546

295. Solvent Refining of Lubricating Oils with Nitrobenzene. S. S. Kurtz, Jr., C. E. Headington and B. Zeiber. *Ind. Eng. Chem., Anal.*, 1936, **8** (1), 1–5.—Describes analytical methods developed to determine the composition of the solvent–oil solution present in any part of the extraction unit in the refining of lubricating oils with nitrobenzene. The latter may be present in the raffinate or extract to the extent of 0–5%, and the determination of this concentration of solvent may be carried out either by its reduction to aniline by titanous sulphate, the excess of the latter reagent being volumetrically estimated by ferric alum, or by use of the Pensky Martens flash-point apparatus. Nitrobenzene lowers the flash point of the lubricating stock under treatment, so it is possible to construct a series of curves relating flash point of the original stock to solvent concentration, up to 1% for the flash-point range 300–600° F. This method is simple and rapid, and used as a periodic check on plant operation, whilst the titanous sulphate method is used only for samples from tanks of finished oil.

For the determination of 5–100% nitrobenzene in oil a specific gravity method and a vacuum distillation method were devised. For the former a series of charts was prepared relating the sp. gr. of the solvent–oil mixture to the volume and weight per cent. of the solvent. To ensure homogeneity sp. gr. was determined at 60° C. and 100° C. In the latter a weighed charge of the mixture was vacuum distilled to a specified liquid temperature, after which the oil was stripped free of the solvent with inert gas, the residual oil weighed and any oil distilling over with the solvent was estimated from the freezing point of the distillate and added to the residual oil.

The determination of nitrobenzene in water (condensed steam) from vacuum pumps and strippers was carried out by modified Evolve method, which consisted of matching against colour standards (ferric chloride cobaltous chloride solutions), the coloured product obtained by the action of sodium hypochlorite on the aniline formed by reducing the aqueous solution of solvent. The analysis of the charging stock with respect to the presence of light oil that would contaminate the solvent in the subsequent operations was carried out either by determination of the Pensky Martens closed and open-flash points and relating the differences to percentage of light oil present, or by a double-vacuum distillation of the charging stock in which the light oil is separated and measured. G. R. N.

621.899 : 608.3

296. Patents on Lubricating Oil and Wax. R. P. Moyer. U.S.P. 2,022,731, 3.12.35. A process for the recovery of used lubricating oil which consists in diluting the oil, centrifugally filtering the solution and subjecting the product to heating in thin films in order to separate the solvent.

665.521.5 : 66.061.5 : 608.3

W. van Dijck. U.S.P. 2,023,109, 3.12.35. Solvent extraction using two counter-flowing mutually non-miscible liquid solvents which are so selected that the components of the liquid mixture have different partition ratios with respect to the solvents.

665.521.5 : 608.3

E. Petty. U.S.P. 2,023,181, 3.12.35. A process of dewaxing hydrocarbon oils which contain a retarder of wax crystallization in the form of colouring material. The oil is diluted and the mixture chilled to a temperature at which the retarding effect of the colouring material is overcome. A portion of the colouring material is removed, *e.g.* by acid treatment, so that complete wax precipitation is obtained on further chilling.

665.521.5 : 608.3

H. Limburg. U.S.P. 2,023,369, 3.12.35. Pour-point reducing substances are extracted from suitable oils by treatment of the latter with an adsorptive agent which is subsequently extracted with a solvent for the removal of the adsorbed pour-point reducing material.

665.521.5 : 66.061.5 : 608.3

W. van Dijck. U.S.P. 2,023,375, 3.12.35. Oil is refined by extraction with a solvent consisting of organic compounds, other than a nitrated monocyclic aromatic hydrocarbon, which contain an NO_2 group or compounds, other than a thiocyanate, which contain a —CN group, and methyl thiocyanate. W. H. T.

621.899 : 608.3

P. Williams. U.S.P. 2,023,986, 10.12.35. An oil reclaimer for reclaiming used lubricating oil. A small portion of the oil is purified and returned to the main portion, which gradually becomes freed of its detrimental volatile constituents, solid impurities being removed by filtration.

621.899 : 608.3

W. T. Bissell and T. W. Potter. U.S.P. 2,023,988, 10.12.35. Removal of waste matter from used journal box waste oil by adding 600 lb. of sodium silicate and 5 gallons of 20% solution of sodium aluminate to about 1000 gallons of the oil, agitating and heating the mixture to above 212° F. to allow precipitation.

665.521.5 : 608.3

H. Levin. U.S.P. 2,024,106, 10.12.35. Preparation of fluorescent and pour-point reducing compounds from cracked residues.

665.521.5 : 66.061.5 : 608.3

B. Y. McCarty. U.S.P. 2,024,107, 10.12.35. Removal of wax from hydrocarbon oils by solvent extraction using *ortho*-dichlorobenzene and an aliphatic ketone, *e.g.* acetone, at — 10° F.

665.521.5 : 66.061.5 : 608.3

L. M. Henderson. U.S.P. 2,024,221, 17.12.35. Production of lubricating oils from mixed base crude oils by fractional extraction with phenylmethylamine.

665.521.5 : 608.3

J. D. Fields. U.S.P. 2,024,968, 17.12.35. Production of lubricating oil of low specific gravity from asphaltic base products requiring sulphur-removal, by treatment with cellulosin vegetable matter.

665.521.5 : 66.094.1 : 608.3

W. L. Gomory. U.S.P. 2,025,384, 24.12.35. Production of lubricating oils by hydrogenation.

665.521.5 : 608.3

J. Mc. A. Harris, Jr. U.S.P. 2,025,387, 24.12.35. Dewaxing of lubricating oils by subjecting them to oxygen-containing gases at 150–500° F. so as to oxidize more than about 5% of the oil; dewaxing is then carried out.

665.521.5 : 66.061.5 : 608.3

J. M. Whiteley. U.S.P. 2,025,965, 31.12.35. Solvent extraction of lubricating oil using phenol and propane.

665.521.5 : 608.3

R. E. Wilson. U.S.P. 2,026,336, 31.12.35. Dewaxing of lubricating oil using propane.

665.521.5 : 608.3

H. T. Bennett. U.S.P. 2,026,491, 31.12.35. Process of making flange oil by distilling under an absolute pressure of 50–200 mm., the residue obtained from the fractional distillation of petroleum. The distillation is continued to provide a residue having a Furol viscosity between 10,000 and 35,000 at 122° F. It is then mixed with 50–75% of a petroleum residue obtained by cracking (of Furol viscosity between 10 and 125 at 122° F.). W. S. E. C.

Fuel Oil.

662.753.32

297. Development of High-Speed Diesel-Engine Fuels. W. Mendius, W. Ainslee and C. H. Schlesman. *Oil & Gas J.*, 14.11.35, **34** (26), 76; *Refiner*, 1935, **14**, 537.—Although the A.S.T.M. have drawn up classifications of fuels suitable for high-speed diesel engines, the situation from the point of view of suppliers is still not satisfactory. This is because many engine-builders still specify characteristics not covered by these specifications. Some of the engine-builders specifications are tabulated, and it can be seen that no single fuel will meet all specifications. This entails multiplicity of grades, and the restrictive nature of some of the characteristics limits the available quantities of fuel far more than do the A.S.T.M. classifications.

Analyses are given of a large number of commercially available Mid-West and East Coast burner fuels meeting A.S.T.M. No. 1, No. 2 and No. 3 burner fuel specifications. In some cases the cetene value is too low for practical use, but No. 3 fuels approach diesel-fuel boiling-range specifications, their viscosity ranges from 34 to 37 secs. S.U. at 100° F., and they appear to be satisfactory with respect to carbon residue, sulphur and pour point. It seems that the present supply of burner fuels offers a logical source of supply for the present diesel-fuel market, and would reduce distribution costs appreciably. The oils of too low a cetene value would automatically be excluded from the diesel-fuel market. The stocks acceptable for diesel usage (cetene value approx. 40 or over) can be readily supplied on the basis of current diesel-fuel consumption, without materially affecting their burner-fuel market. Alteration in characteristics of the fuels to accommodate both requirements might reasonably be made in the future.

Burner fuels of to-day are generally derived from cracked products or their blends with straight-run stock. Tables show the approximate quantities of straight-run and cracked gas oils available in various areas and the properties of such oils. The cracked oils generally have a lower cetene number than the straight-run oils from the same crude, whereas the straight-run oils sometimes possess higher pour points, necessitating dewaxing if a specification of 0° F. pour point is demanded. Furthermore, straight-run oils for diesel consumption must compete with the value of this stock as a source of high anti-knock cracked gasoline. Restrictive specifications such as are in force at present will therefore tend to increase the cost of the fuel owing to competition from other markets and to additional refinery processing. These factors should be borne in mind in future engine development. R. A. E.

Asphalt and Bitumen.

625.84

298. Road Construction Machine. *Oil & Gas J.*, 23.1.36, **34** (36), 32.—A new process for road construction has been developed in Missouri, in which asphaltic oil, carefully suited to the soil by laboratory experiment, is spread below the surface by a machine, consisting of a set of hollow steel teeth 6 in. long mounted on a heavy "A"-shaped frame. As the teeth are drawn through the earth, asphaltic oil is pumped through an opening in the lower end of each tooth. The oil spreads laterally and vertically to a thickness of 5 or 6 in. After curing, the road is compacted by rollers and by traffic, leaving a waterproof mixture of asphaltic oil and earth.
C. L. G.

625.752

299. Adhesive Power of Road Tar. H. Mallison. *Asphalt u. Teer*, 1935, **43**, 884–886.—It is stated that adhesive power is the resultant of a number of properties, and cannot be directly measured as such; the separate properties of the tar can, however, be examined and conclusions reached as to its adhesive power, but the nature of the stone must also be considered. The factors influencing adhesive power are: cohesion, viscosity, thickening of the tar, water resistance, adhesion of the tar to stone, tension of the stone and filler constituents and proportion of binder to stone mixture. These factors are considered in detail. A. O.

625.752

300. Adhesion of Stone and Bituminous Binders and its Practical Importance. P. Herrmann. *Asphalt u. Teer*, 1935, **44**, 905–908.—The conclusions of Geissler, Riedel and Weber in relation to the adhesion of bituminous binders to stone are critically examined, and the process and factors affecting adhesion are discussed at length.

In the author's opinion, true adhesion between pure stone and binder is of secondary importance in practice, whereas, in addition to roughness of the stone surface and porosity of the stone, the following factors are of great importance: moisture content of the stone, insulating layers of dust on the stone, presence of swelling materials on or in the stone or binder. A. O.

625.752.3

301. Use of Bitumen Emulsions for Road Construction. —. Bosenberg. *Asphalt u. Teer*, 1935, **35**, 1063–1064.—Brief descriptions are given of the two main types of bitumen emulsion, viz. quick-breaking and slow-breaking, together with their applications for road treatment. C. C.

665.45 : 31

302. International Bitumen Statistics. W. Schmidt. *Bitumen*, 1935, **5**, 201–206.—Figures are given for the total production of bitumen in the most important countries of America, Europe and Asia. America produced 70% of the total output (3,620,000 tonnes), whilst in Europe the figure was 1,390,000, of which Great Britain contributed 417,000 tonnes (8·1% of the world production).

Figures are also given for imports and exports for individual countries. Great Britain imported 63,340 tonnes and exported 90,000 tonnes. Further figures given include the figures for natural asphalt and statistics applying particularly to Germany. C. C.

665.521.72 : 66.061.5

303. Preparation of Asphalt by Solvent Extraction Processes. R. Fussteig. *Teer u. Bitumen*, 1935, **34**, 429–433.—Good-quality lubricating oils are said to be obtainable from high asphalt content oils by means of solvent extraction processes, and the asphaltic resinous extract also converted into asphalt suitable for road construction purposes. A paraffin-free Polish residue gave a first-class cylinder oil on treatment with phenol, whilst the asphaltic extract, after removal of the phenol and further treatment with *m*-nitrobenzyl alcohol, yielded 48% of lubricating oil, suitable for use at relatively low temperatures, and 52% of asphalt. The properties of the various materials and penetrations and ductilities of the asphalt at temperatures ranging from 0 to 25° C. are tabulated. Details are also given of a plant suitable for large-scale operation of this process. A. O.

665.521.8

304. Oxygen Absorption Tests on Asphaltic Constituents. R. R. Thurston and E. C. Knowles. *Ind. Eng. Chem.*, 1936, **28**, 88.—Soft and air-blown Mexican asphalt, gilsonite, and other asphalts were examined and groups of constituents separated, *e.g.* asphaltous acids, asphaltenes, petroleum resins, asphaltic resins and oils. The original asphalts and the constituents of soft Mexican asphalt were subjected to treatment with oxygen in a closed system at 200° C., and under atmospheric pressure. The volume of oxygen absorbed was measured and the distribution of this oxygen in the products of the reaction determined. It was found that the solid constituents, the asphaltenes, oxidized most readily, and the oils were more resistant. The effect of oxygen on the properties of the constituents is discussed.

The oxidation of petroleum residua is important economically, since useful asphalts can be made by this means from residua which are unsuitable for asphalt manufacture by the usual distillation processes. It is also possible to manufacture asphalts of high softening points which are pliable, have good resistance to weathering and are less susceptible to temperature change than any other type of asphalt.

W. S. E. C.

665.521.8

305. Manufacture, Packaging and Shipping of Oxidized Asphalts. Art. 10. C. J. Holland. *Petr. Eng.*, Nov. 1935, **7** (2), 36.—The series of articles concludes with a description of the packaging and shipping arrangements and general layout decided upon for the Mexican oxidized asphalt plant under consideration. Seven 1000-brl.-capacity drum-filling tanks were to be installed, equipped with live-steam coils and shell-type steam-jacketed drum-filling spouts, together with a 4000-drums-per-day-capacity iron-drum factory. It was found that machine side seaming of drums was more economical than electrical welding and produced a perfectly tight seam. The cooling-shed capacity is estimated on a basis of 5·3 sq. ft. of cooling space per drum, 5·3 days being required for filling, cooling, topping, sealing, weighing and stencilling. Avoidance of topping off would reduce the time by 30–35%, but the use of the removable rings (see Article 2) has been used only for the one-headed domestic drums, and not for the export types. C. L. G.

665.521.8 : 668.3

306. Patents on Asphalt. F. S. Dengler, E. W. Gardner and D. H. Felder. U.S.P. 2,024,096, 10.12.35. Stable homogeneous asphalt is prepared by blending air-blown cracked residue with an air-blown uncracked asphaltic residue. The latter is claimed to stabilize the unstable insoluble compounds present in the cracked residue and to inhibit their formation and segregation.

665.521.8 : 668.3

C. M. Baskin. U.S.P. 2,025,709, 31.12.35. A rapid-setting liquid asphalt (viscosity 200 Furol at 122° F.) comprising a solution of at least 70 parts of asphalt (80–100 penetration), derived from a cracking process, in cracked distillate.

665.521.8 : 668.3

G. R. Hoover. U.S.P. 2,026,039, 31.12.35. The "adhesive-life" of asphalts is increased by simultaneous air blowing and treatment with gaseous ammonia.

665.521.8 : 668.3

H. T. Swerissen. U.S.P. 2,026,073, 31.12.35. Asphalt is prepared from residues containing naphthenic soaps by treatment with mineral acid, whereby a portion of the soap is decomposed. The neutralized residue is then converted into asphalt. W. H. T.

Wax.

665.42

307. Ozokerite and Ceresin. Anon. *Neft*, 1931, **2** (17), 15–18.—In the ceresin plant at Rostokino (Moscow) the crude ozokerite is melted at 120° C., transferred by means of air pressure into a still where 20–35% oil is taken off at a vacuum of 680 mm. and a final temperature of 300° C., the oils being partly re-worked and partly used for fuel. The remaining "standard ozokerite" is run into moulds or passed into acid agitators, where the treatment is carried out at 130–150° C. with a mixture of acid and oleum (2 : 1), the temperature increasing gradually to 210° C.; thus removing excess acid. The ozokerite is then neutralized with lime and treated with clay, the treatment causing a loss of up to 50% ozokerite. It is then cooled to 160–170° C. and filtered, further acid and clay treated until white ceresin is obtained. The sludge (50%) is placed in sacks and extracted with naphtha at 70° C. for 27 hours. The solution is filtered through Kelly presses at 55–60° C. and not over 2 atmos. pressure; the gasoline is then distilled off and the ceresin poured into moulds. For. Petr. Techn.

665.521.6

308. Manufacture of Paraffin. A. M. Ravikovich, A. I. Voronov and Y. A. Kublo. *Grozn. Neft.*, 1934, **4** (9), 28–31.—The Grozny paraffin filtrate has a pour point of about 8° C. and an E_{50} viscosity of 1·25. It may be filtered at − 15° C. without lowering its viscosity, yielding a slack wax suitable for sweating. The latter must be carried out at temperatures lower than usual. The slack wax obtained in the second

filtration yields valuable low-melting-point paraffins with a yield of 7·2% on the original distillate. The first filtrate yields: 10% wax, m. p. 52–55° C., the filtrate amounts to 88% of the distillate, the former contains 10·2% paraffin. The corresponding figures for the second filtrate are: 7·2, 41–43, 75, 1·8.

For. Petr. Techn.

665.521.6

309. Recording Waxes. V. Williams. *Ind. Chem.*, 1935, No. 129, Vol. XI, Oct., 400.—These waxes of melting point between 190° and 220° F., which are tough and polish well, are of two classes: (1) those prepared from stearine, (2) and those from montan wax.

(1) Stearine is heated with oxides, hydroxides or carbonates of lead and sodium. Lead soaps act as hardeners, and destroy the crystalline nature of the stearine, whilst sodium soaps give transparency, elasticity and minimum shrinkage. This combination gives a recording wax of the required properties such as hardness, non-hygroscopic and minimum shrinkage on casting.

(2) These are made by treating montan wax in a similar manner, but with final addition of paraffin wax. It is claimed that these mixtures have better recording properties than the stearine products.

R. E. D.

Special Products.

665.413

310. Refining of Petrolatum. Tokmanov and Rodzaevskaya. *Azerb. Neft. Khoz.*, 1934, **11–12**, 107.—170–770 parts of crude petrolatum are treated with 150–750 parts nitrobenzene, then (*a*) a yellow petrolatum is obtained by treating the nitraffin (80 parts) with 10 parts of clay and adding 50 parts of oil to 75 parts of the filtrate, and (*b*) a white petrolatum is obtained by treating 80 parts of the nitraffin with 10% acid and 20% clay, then adding 50 parts of white oil to 70 parts of the filtrate.

For. Petr. Techn.

665.516

311. Raw Material for the Preparation of Petroleum Soap. K. Bagirov. *Neft*, 1931, **2** (15), 19–20.—Diluted alkali sludge is mixed with kerosine and gas oil alkali sludge (3 : 1), and 15–20% kerosine is added. The mixture is heated with closed steam to 100–105° C. with agitation by air. After 4 hours' settling, two layers are obtained, the upper containing mineral oil and kerosine, and the lower containing the soap and kerosine. The soap layer is freed from kerosine by distillation, and the latter can be used again. A petroleum soap meeting the specifications is thus obtained.

For. Petr. Techn.

665.545

312. Synthetic Acids from Grozny Petroleum. R. I. Berlin and A. N. Kuznetzova. *Groz. Neft*, 1935, **5** (1), 52–56.—Export paraffin was oxidized by blowing with air at 160–170° C. yielding a product of 50–60 acid no. and 140–150 saponification no., containing 36–40% unsaponifiable substances, 26–28% fatty and 6–9% hydroxy acids. Foots oil containing 50·99–86·55% paraffin wax was oxidized in the presence and absence of naphthenate catalysts; the yields of oxidized products from oil high in wax were satisfactory without catalysts, but oils having less than 85% wax needed a catalyst to produce satisfactory yields. The unsaponifiable ingredients were subjected to a second oxidation yielding satisfactory results without the use of catalysts. The yields were (on the fraction used for a second oxidation): fatty acids 17·72–35·21% and hydroxy acids 5·47–7·2%. The experimental procedure is described in detail.

For. Petr. Techn.

667.624.1

313. Aluminium-Tar Paints. Anon. *Teer und Bitumen*, 1935, **33**, 457.—These paints may be of two types: (1) an aluminium paint with an oil varnish basis which is applied on to a previously tarred surface, (2) a paint which consists of a dispersion

containing both aluminium and tar applied directly. In the former case thorough drying out of the surface is essential; in some circumstances at least a year should elapse before the application of the aluminium paint. The painting itself must be carried out rapidly, in one direction only. The second type of paint has been tested using special containers in which steel plates coated with the paint may be subjected to variation in temperature, to moist atmospheres, to sea water, etc. A mixture of 81·5% tar and 18·5% gas-works solvent gave poorer results than the same mixture with the addition of 13% aluminium powder. C. C.

667.624.17

314. Bituminous Paints. H. Walther. *Teer u. Bitumen*, 1935, **33**, 456–457.—The softening point is not in itself an adequate test for the suitability of a bitumen for paint-making; the brittleness of two bitumens of the same softening point may be quite different. A better indication is obtained from the difference between the softening point and breaking point. The greater the difference, the more resistant is the product against mechanical shock, vibration, temperature changes, etc. Blown bitumens give a larger difference than coal-tar pitch, which is very susceptible to temperature changes. The addition of fillers, however, improves this latter product in this respect. Bituminous paints are very resistant to water. Pitch is slightly superior to blown or vacuum-produced bitumens in this respect, and also shows better adhesion. Blending bitumen with a small amount of anthracene oil improves the adhesion. Alternatively, a preliminary coating of pitch paint may be applied. Pitch is more weather resistant as regards colour stability than blown bitumens. The acid content of the latter also tends to make them less suitable for zinc or galvanized materials. If hot bitumen is to be used, a pretreatment, *e.g.* with a solution or emulsion of bitumen, is necessary. Anthracene oil is an excellent material for the preliminary coating. C. C.

665.58 : 608.3

315. Patents on Special Products. J. Y. Johnson. E.P. 439,491, 2.12.35. Recovery of dienes from crude hydrocarbons by treating them with paraquinones when addition compounds are formed. These are separated from the hydrocarbons before adding fresh quantities of paraquinones. W. S. E. C.

547.22 : 608.3

B.T.H. Co. E.P. 440,136, 20.12.35. Halogenated hydrocarbons are refined by distillation followed by prolonged contact with adsorbent material at elevated temperatures. W. H. T.

Detonation.

621.43.019.6

316. Influence of Temperature on the Limits of Inflammability of Combustible Vapours and Air Mixtures. M. Briand. *Ann. des Comb. Liq.*, 1935, **10**, 1129–1185.—The author discusses the historical aspect of the subject at some length. The apparatus chosen resembled that of Yannaquis, and consisted of a pyrex bottle of about 2½ litres capacity, about 9 cm. diameter, furnished with a brass collar and cap. Through the latter passed a stirrer, thermometer and two admission tubes. The whole bottle, if required, could be placed inside an electrically heated furnace. Experiments to determine the maximum and minimum limits of inflammability over a temperature range of 100–300° C. have been recorded for the following substances: *iso*pentane, hexane, heptane, octane, benzene, toluene, *cyclo*hexane and *cyclo*hexene, methanol, ethanol, propanol, acetone, as well as for mixtures of these. In addition, the effect of water vapour on the limits for ethanol has been investigated at 150° C. It appears that alcohol containing up to 80·5% of water can give inflammable mixtures with air, but a greater water content renders inflammation impossible. For all the substances examined, the variation of the limits of inflammability with temperature was a linear function over the range of temperature where slow oxidation was not too marked. This conclusion is similar to that of White in work with gaseous mixtures. For binary mixtures not containing more than 7%, and ternary mixtures not containing

more than 10%, of carburant, Regnault's law is obeyed at all temperatures, *i.e.* the limits for a mixture may be calculated from those of its components. Various gasolines and gasoline–benzole blends have been investigated. In most cases, these also give linear variations for inflammability limits with temperature change. W. E. J. B.

Engines.

621.43 621.436

317. Cost of Operating Automotive Diesels Compared with Gasoline Motors. C. G. Anthony. *Oil & Gas J.*, 22.11.35, **34** (27), 35.—A careful audit and study have been made of the operating experience of Pacific Freight Lines, probably the largest trucking concern operating any appreciable quantity of diesel-powered equipment in the U.S. In the territory of operation there is a wide variation in operating conditions. From the fleet 20 Sterling trucks were chosen, 10 powered by Cummins Diesel motors and 10 by Waukesha "AB" gasoline motors. Each pulled a 6-wheeled trailer and was operated at an average gross-weight load factor of 70% or 47,600 lb. Certain factors were found to be constant for both types, so that cost items considered were: fuel, lubricants, maintenance, depreciation, interest on investment, and fire and theft insurance. The study of the diesel trucks was made for the first 4 months of 1934 and 1935, and the study of the gasoline engines for the first 4 months of 1934 only. The gasoline engines operated on gasoline of approx. 70 octane number costing 12·16 cents per gal., and the diesel engines on fuel of viscosity S.U. at 100° F. of 40–43 secs., cetene number 50–55, Conradson carbon residue 0·05–0·10%, sulphur 0·5–0·7%, costing 3·51 cents per gal. in 1934 and 4·16 cents in 1935. The mileage covered in each series ranged from 184,500 for the gasoline engines to 268,500 for the diesel engines.

The salient conclusions of the study are:

(1) A diesel motor runs 60–65% further on a gal. of fuel than a gasoline motor, so that cost of fuel in these tests was about 6 times greater with the gasoline engines, (2) a diesel engine uses slightly more lubricating oil, and all other expense items, such as repairs, depreciation, interest and insurance, are greater for the diesel engine than for the gasoline engine. The comparative figures per mile expressed in cents are:

	Average of diesel engines.	Average of gasoline engines.
Fuel costs	0·638	3·947
Oil costs	0·321	0·294
Repairs	2·148	1·689
Depreciation	2·960	2·700
Interest	0·396	0·366
Insurance (fire and theft)	0·067	0·061
Total	6·530	9·057

It is probable that, with increase in production of diesel engines and improvement in design, the overhead costs will be reduced to the level of those applying to gasoline engines. R. A. E.

621.43.033

318. Freezing in Carburettors. A. Swan. *Aircraft Engineering*, Jan. 1936, **8** (83), 3.—The formation of deposits of ice in the carburettors of aircraft engines leads to a reduction in the power output and irregular running, and in severe cases may completely throttle the engine, resulting in a forced landing.

The atmospheric conditions most likely to promote ice formation in an unheated carburettor are stated to be when the air temperature lies between − 10° C. and + 18° C., in conjunction with a high humidity, this latter being the determining factor. Any heat given to the air or the carburettor will reduce this range of temperature.

Fuel volatility is shown to be unimportant as a cause of the formation of ice, although the deposits will tend to become more serious with fuels of greater volatility.

A device is described for the detection of ice in the carburettor during flight, and which was used for the examination of the prevention or removal of ice deposits.

Jacketing of the carburettor is suggested as a possible means of prevention of freezing, but it is shown that this method is too cumbersome and difficult to control to be practicable.

Intake heating may be successfully applied, but has the disadvantage that at full throttle the power output is thereby reduced. This can be overcome by providing the carburettor with optional cold and warm intakes, which can be either manually operated, or coupled to the throttle control.

The effect of the alcohols in removing ice was demonstrated in some experiments with a glass induction pipe. On the addition of alcohol, the ice was immediately softened into a wet mass which was easily dislodged by vibration or was scrubbed off by the air flow.

The addition of alcohol to the air stream was found to be uneconomical, and blending alcohol with the fuel introduced difficulties with regard to separation taking place should the fuel come into contact with water. However, about 5% of a mixture of equal parts of methanol and ethanol mixed with the fuel was found to prevent serious deposits of ice.

An automatic de-icing device is described which injects alcohol into the carburettor only when required. The quantity of alcohol used is equivalent to 2½% of the fuel for continuous freezing conditions, but if it is desired only to prevent serious deposition of ice, then 1% would be sufficient. For normal flights in which freezing conditions do not prevail for the whole of the time, only about ½% of alcohol would be required.

The consumptions of alcohol for the automatic de-icer apply only if an alcohol consisting mainly of methanol is used. Larger amounts of ethanol and still larger amounts of propanol would be required.

Some recommendations are given as to suitable materials for the carburettor which are unattacked by the alcohols. J. G. W.

General.

622.323 665.54

319. Oil-field and Refinery Development. *Oil & Gas J.*, 26.12.35, **34** (32), 117–180.—A number of articles describe new developments which have taken place in the world, excluding U.S.A., in connection with drilling and production methods and with refinery construction and operation. Statistics regarding crude production are given, also a complete list of refineries showing location, daily capacity, cracking capacity and type of plant.

Amongst the plants described are: the Gonfreville and Martigues refineries of the C.F.R. in France, operating on Iraq crude; the new Belgian refinery at Antwerp associated with Redeventza S.A.; the Kermanshah Petroleum Co. refinery at Naft-i-Shah in N.W. Iran; extensions to the N.K.P.M. plant at Palembang, Sumatra; developments in U.S.S.R.; extensions to the Egyptian Government refinery at Suez. R. A. E.

665.5 : 66(47)

320. Petroleum Industry of the U.S.S.R. I. Ganitzchi. *Mon. Petr. Roum.*, 1936, **37**, 27–30.—The western portion of the northern Caucasus represents the territory of the trusts Cubtcherneft and Maineft. The territory is described, and a brief historical summary of the fields is given. In 1934, the two trusts produced nearly a million tonnes of crude, with Maineft contributing about 94%. The low figures are explained as due to lack of credit for drilling, but work in 1934 promises important developments in the Apcheronskaia and Hadâjenskaia fields of the Maineft. The peninsula of Tamani has seen little development, but a well of 500 metres gave a crude of 0·816 gravity with 27% gasoline. Gubkine has divided the Maikop horizon into five different layers, the lowest giving the lightest crude. This formation comprises all the producing territory of the two trusts. Various estimates of the reserves of this region are given. The article concludes with a discussion of the increased rail transport of petroleum products in the U.S.S.R. during 1935. An increased traffic of 21·6% over 1934 was shown. W. E. J. B.

665.5 : 66(47)

321. Petroleum Industry of the U.S.S.R. I. Ganitzchi. *Mon. Petr. Roum.*, 1935, **36**, 1783–1788.—*The Grozneft Trust*: This trust operates four fields, viz. Staro-Groznyi, Novo-Groznyi or Octiabrskyi, Malgobek and Dagestan, of which the second field is the most important, and in 1931 had a peak production of 7,422,700 tonnes. The Trust showed a decline in production from 1931 to 1934, but increased drilling activity during 1934–1935 promises better results for 1935. During 1934 and 1935 considerable success attended the Malgobek field, and a production of 700,000 tonnes is considered easily possible for 1935; in fact, a figure of 1,000,000 tonnes may be reached. The development of this field is seen by the fact that in 1931 production was only 67,100 tonnes. The field has been developed under great difficulties. The considerable drilling programme planned for this region is described, as well as geophysical studies. At Novo-Groznyi the 1935 programme includes 8 wells (total depth 15,000 m.), with the object of studying the Maikop horizon. Reference is made to the Stertshi-Kertshi well sunk in the Benoi field (Gornaia Tshetshinea), which gave a crude of very light colour and gravity (0·819–0·820). It appears that in 1937 the Grozneft Trust will control much wider territory.

The Azneft Trust: Figures are quoted which illustrate the fact that the bulk of the production under this trust is derived from wells sunk after the nationalization. Lower horizons are being developed than heretofore. The production of the various fields under Azneft is given in tabular form, which shows important fields to be Balachany, Bibi-Eibat, Surachany, Kara-Ciuhur, Kala and Lok-Batan. Incidentally, these fields now bear new names. The total production of the Trust for 1934 was about 19½ million tonnes, nearly 80% of the total for the U.S.S.R. Exploration has shown that between the island of Artem and the Apsheron peninsula the Baku region extends, but development did not start in 1935 for financial reasons. The Trust sunk, in 1934 and 1935, wells totalling 118,049 metres. In July 1935 the Azneft was decentralized, and four new trusts were formed, viz. Stalinneft, Ordjonkidzeneft, Azizbekneft and Leninneft. Thus, there are now fourteen trusts producing in the U.S.S.R. A new refinery is being constructed in Bachkiria, on the River Ufa, capable of treating 160 wagon-loads a day, with provision for a possible capacity of twice this amount. Crude from the Ichimbaevo field will be treated, and the plant contains pipe stills and cracking equipment. W. E. J. B.

665.5 : 66(47)

322. Petroleum Industry of the U.S.S.R. I. Ganitzchi. *Mon. Petr. Roum.*, 1936, **37**, 123–127.—The immense district stretching from "Novaia Zemlea" archipelago in the Arctic Ocean to the northern shore of the Caspian Sea, constitutes the second petroleum reserve of the Soviet. It is administered by four trusts, *e.g.* Prikamneft, Vostoconeft, Embaneft and Turkmenneft. During the November meeting of the Academy of Sciences three papers were presented dealing with the Oural–Emba district. I. Goubkine considered that the production of the four trusts should be raised to 25 million tonnes a year during the Third Five-Year Plan. Credit facilities will determine this, but the Emba trust alone is considered capable of reaching the figure quoted. Seven fields in the Emba district are producing, of which Dossor and Makat are the principal ones, but the Kostshiagâl field gave 60,000 tonnes during October–December 1935. In this field, as well as the Iskiné field, the productive strata are situated at the periphery of the respective domes. The latter field gives a crude which has about 60% light fractions, whilst it is claimed that excellent lubricating oils can be refined from it, with very good viscosity–temperature characteristics. Development difficulties are discussed. W. E. J. B.

REVIEWS AND BOOKS RECEIVED.

Reviews.

621.436(02)

STANDARD PRACTICES. Pp. xiii + 162. 1935, Diesel Engine Manufacturers' Association, New York.

Some five years ago this Association published a similar volume to the present one, which has now been brought up to date in the light of present practice. The book is primarily intended to act as a guide to buyers and sellers, and aims at removing misunderstandings due to lack of definition of terms and practices. It deals in the main with heavy duty, low- and medium-speed stationary power plants of 200 H.P. and upwards, although, of course, much of the information and definitions applies to all types of internal-combustion engines.

Details are first given of limits regarding air temperature, barometer, etc., between which an engine must run when determining its brake horse-power at sea-level, which includes any altitude up to 1500 ft. This standard rating must be such that the engine will deliver up to 10% in excess of such rating for two out of any 24-hour period of running with safe operating temperature.

Specifications are given on similar lines for higher altitudes, and an engine fitted with super-charger shall be considered as operating at an altitude corresponding to the super-charging pressure. Fuel consumption must also refer to the same general conditions of operation with fuel of 19,000 B.Th.U. per pound gross. When a buyer demands a guarantee of performance on site, a set of rules is laid down for such field tests, although such tests are not encouraged owing to their high cost. Minimum standard equipment and service are also specified, together with margins above or below any critical speed which must be observed in the case of constant-speed engines. In this chapter also clear definitions are given for every type of engine and separate piece of equipment forming the unit, together with definitions of practically every term in common use bearing on I.C. engines.

The next chapters give a comprehensive review of the cost of diesel power, and valuable information regarding the selection of suitable types of plant having regard to the nature of the daily power load curve.

Chapters IV to VII give information pertaining to power-house design, which includes pipe-trenches, foundations, necessary space, etc. Special features of the more unusual designs are also dealt with and specifications of governor performance are given.

Chapters VIII to XI deal respectively with fuel oil storage and handling, lubricating-oil systems, cooling-water systems, intake and exhaust systems, together with starting air equipment and heat-recovery apparatus. These four chapters should be of the greatest assistance to the engineer contemplating a diesel installation, as they are well illustrated and give a comprehensive description of the necessary plant auxiliary to the actual engines, generators, etc.

After giving a description of different types of generators and electrical equipment, the remainder of the book, consisting of some 50 pages, is devoted to suggestions covering the preparation of invitations for bids and detailed specifications. This section, again, should be of very real use in preparing inquiries for plant, and it would seem to be almost impossible to overlook anything of importance if reference is made to this section of the book.

The volume, although a comparatively small one, and although dealing in a very brief way with many items, should nevertheless accomplish what it sets out to do, viz. minimize misunderstanding between the manufacturer and the customer, and although it is obviously most useful to engineers in the country of its origin, much of the information should be very valuable generally. C. H. SPRAKE.

621.436(02)

DIESEL ENGINES. J. W. Anderson. Pp. viii + 491. 1935, McGraw-Hill Publishing Co., Ltd., London. 30*s*.

This book is a review of the position of the diesel engine in the U.S.A., almost without reference even to outstanding designs developed elsewhere unless they are being manufactured in America.

The author expresses his intention to picture the diesel engine as it is to-day; to show typical constructions; to analyse designs; to explain reasons for designs; to explain essentials; to help the user to know whether a diesel engine is the answer to his power problem, and to assist the operator and user to get satisfactory performance from the diesel engine.

Starting with a brief historical statement, the author proceeds to outline the theory of the diesel engine in a chapter too advanced for the average user and much too elementary for the serious student or designer. He makes the surprising statement that thermodynamics teaches us that the thermal efficiency of *any* heat engine is expressed by the equation

$$\text{Efficiency} = \frac{T_1 - T_2}{T_1}$$

and, although he follows with a comment on the loss of efficiency consequent on after-burning, no mention is made of the relative efficiencies of the constant-volume, constant-pressure and mixed-pressure cycles, nor of the possible losses between combustion in an air cell and the appearance of useful pressure above the piston. It is also stated that the fuel is injected under full control as to time and quantity, so as to produce the desired shape of indicator card, and it is assumed that temperature alone, irrespective of pressure (or oxygen density), is the criterion for ignition of the fuel.

It is inferred that combustion at a given mean pressure is necessarily less complete in high- than in slow-speed engines, and an allowance of 100% excess air is said to be necessary for complete burning of the fuel.

These are but a few of many weaknesses which impair the value of the book for students and designers, and which must mislead any diesel-engine user who tries to read it thoroughly.

About a hundred and fifty pages are devoted to brief catalogue descriptions covering automotive, mobile-machinery, stationary, railway, "oil-country" and aviation engines.

The remainder of the volume deals with details under the headings of design characteristics; scavenging, charging and supercharging; combustion chambers; fuel-injection systems; design details; governors, control and safety equipment; cooling and water-cooling systems; lubrication and lubricating systems; fuels and fuel systems; starting systems; waste-heat utilization; installation; and concluding chapters on operation and maintenance, performance, and the selection of an engine.

Much of the detail given should be of interest to a discriminating designer who can sift doubtful from sound practice, but he will often find his interest aroused by a statement of a problem and be disappointed by the absence of its solution.

The engine user is advised that no laboratory tests have yet been devised that exactly duplicate engine-operating conditions, and that it is much better to buy lubricating oil on the basis of known brand name, good oil being cheapest in the long run.

Recommendations regarding fuels follow the same course. "Buy fuel only from a reputable dealer. . . . In all cases it is well to try out a strange fuel in small quantities before filling the tanks with it."

Brief reference is made to the various customary specification details for fuel oils, such as specific gravity, heat value, flash point, pour point, water and sediment, carbon residue, ash, sulphur, distillation temperature and viscosity, but no mention is made of the recent tentative classification of fuels by the A.S.T.M.

Ignition quality is agreed to have become the most important specification point for fuel for small engines, and the Diesel Index is given as a means of grading for quality, although without any details of its derivation or description of the very simple test required for its determination.

As an analysis and explanation of design the book is inclined to be elementary, although it may offer useful suggestions to the designer who already knows his subject well; as a guide to the average user it contains much unnecessary material; as a picture of the diesel engine as it is to-day in the U.S.A. it serves its purpose.

R. STANSFIELD.

541.184.4(02) 66.063.6(02)

THE THEORY OF EMULSIONS. W. Clayton. Pp. ix + 458. 1935, J. and A. Churchill, Ltd., London. 25*s*.

This is the third edition of the book, and represents a complete and up-to-date summary of the latest literature on emulsions. The theories of emulsification and of emulsions are discussed in detail with, incidentally, full discussion of such factors as surface tension and absorption at liquid–liquid interfaces. A chapter is devoted to the various types of emulsifying agents which are used, and in addition to the general considerations underlying the choice of emulsifying agents, special reference is made to the patent literature. The important properties of emulsions, such as concentration, viscosity and stability, are very fully discussed, together with the published experimental work on these subjects.

Under the heading of "Miscellaneous Emulsions," the manufacture, and such properties as rate of break, of asphaltic bitumen emulsions are described, and in this connection a detailed reference is made to the work of recent workers, such as Weber and Bechler, and their associates, on the mechanism of the breaking of bituminous emulsions in contact with stone.

Many other subjects of direct interest to the petroleum industry are dealt with. An appendix deals specially with the separation of technical emulsions, particularly crude oil-field emulsions, and in other parts of the book references are made to wax emulsions, textile emulsions and agricultural sprays. The addition of a section, under "Miscellaneous Emulsions," dealing with soluble cutting oils, might be considered for incorporation in a future edition of this work.

Special attention is devoted to technical emulsification by the use of colloid mills, and physical measurements on emulsions.

The book as a whole can be considered indispensable to all dealing with industrial emulsions, largely owing to the very detailed and up-to-date reference to the literature of the subject. F. H. GARNER.

Books Received.

British Standards Institution :

625.85.063

B.S.S. 598–1936. METHODS FOR THE SAMPLING AND EXAMINATION OF BITUMINOUS ROAD MIXTURES. 39 pp. 1936, London, British Standards Institution. 3*s*. 6*d*. net. Postage 2*d*.

These methods of sampling and testing have been drawn up for use in connection with the various British Standard Specifications for asphalt road surfacings, and provide a standard procedure for their examination before and after laying.

The methods of sampling refer to asphalt, asphaltic concrete, rock asphalt, mastic asphalt, and tarmacadam. The methods of examination include apparent specific gravity; voids; bitumen content of asphalt, mastic asphalt, and tarmacadam; water content of asphalt and tarmacadam; and various tests on mineral aggregate.

Department of Scientific and Industrial Research :

662.743

THE ACTION OF HYDROGEN UPON COAL. PART II. EARLY EXPERIMENTS WITH THE BERGIUS PROCESS. L. Horton, F. A. Williams and J. G. King. Fuel Research Technical Paper 42. vi + 58 pp. 1935, H.M. Stationery Office, London. 1*s*. 3*d*. net.

The action of hydrogen upon coal at high pressures and temperatures has been studied at the Fuel Research Station since 1923, and Part I (1931) of this series of papers dealt chiefly with the effect of hydrogen on coking properties. The present work gives the results of many early experiments on the conversion of British coals into oil and gives a history of the action of the Department and its connection with other interested bodies.

338 : 622.33

JONES, JOSEPH. THE COAL SCUTTLE. 168 pp. 1936, Faber and Faber, Ltd., London. 5s. net.

The author, who is the President of the Mineworkers' Federation of Great Britain, in dealing with general conditions in the British coal industry, discusses the future of the industry and makes brief reference to obtaining oil from coal by the low-temperature carbonization and hydrogenation processes.

U.S. Geological Survey :

55(788)

BULL. 843. A BRIEF REVIEW OF THE GEOLOGY OF THE SAN JUAN REGION OF SOUTH-WESTERN COLORADO. W. Cross and E. S. Larsen. vi + 138 pp. 1935, Superintendent of Documents, Washington, D.C. $1.00.

55(798)

BULL. 866. GEOLOGY OF THE TONSINA DISTRICT, ALASKA. F. H. Moffit. 38 pp. 1935, Superintendent of Documents, Washington, D.C. 40 cents.

665.5 : 66(498)

VAN DER HOOG, E. BETRACHTUNGEN ÜBER DIE RENTABILITÄT DES AUSFUHR-HANDELS MIT RUMÄNISCHEN PETROLEUMPRODUKTEN. 185 pp. 1935, N. V. Drukkerij en Uitgeverszaak de Mercuur, Hilversum. 10s.

In discussing the Rumanian petroleum industry the author includes many statistics of production, exports and imports, together with historical information regarding the petroleum industry in Europe.

ABSTRACTS.

	PAGE		PAGE
Geology	118 A	Gas	151 A
Geophysics	127 A	Motor Fuels	151 A
Drilling	132 A	Lubricants and Lubrication ...	158 A
Production	136 A	Fuel Oil	161 A
Storage	140 A	Wax	163 A
Chemistry of Petroleum ...	140 A	Asphalt and Bitumen	164 A
Analysis and Testing	143 A	Special Products	165 A
Refining and Refinery Plant ...	146 A	Engines	168 A
Cracking	148 A	General	169 A
Hydrogenation	150 A	Reviews and Books Received ...	173 A
Crude Oil	150 A		

AUTHOR INDEX.

The numbers refer to the Abstract Number.

Ahlberg, C. R., 426
Albright, J. C., 373, 374, 376
Alther, J. G., 412
André, E., 394
Arbusov, V. S., 410
Arce, E. H., 466
Asadov, I. M., 377
Asquini, A., 468
Auld, S. J. M., 441
Ayres, E. E., 394

Baker, R. C., 368
Baker, W. L., 369
Balk, R., 324
Balyabo, I. K., 407
Barnes, J. B., 414
Barton, D. C., 320
Bass, N. W., 325
Bataafsche Petroleum Mij., 433, 443, 463
Batcher, R. R., 399
Beardmore, H. F., 384
Beckwith, L. B., 453
Behimer, O., 414
Bignell, L. G. E., 348
Birkhimer, E. R., 443
Boerlage, G. D., 403
Bogolyubskii, V., 360
Böhme, H. T., 416
Boru, W. T., 354
Borts, S. M., 377
Both, S., 409
Boulanger, L., 414
Bramlette, M. N., 327
Brande, E. M., 451
Bray, U. B., 453, 463
Bredberg, L. H., 381
Brooks, B. T., 335, 408
Brown, G. C., 422
Burns, E., 368

Carlstrom, J., 414
Chaney, L. V., 433
Charigin, M. M., 382
Charrin, P., 345
Chemical Works, 415
Chenault, R. L., 378
Cissa, W., 416
Clarke, L. A., 443
Cosine, R. C., 379, 380
Corey, W. H., 328
Cottrell, O. P., 433
Coubrough, G. B., 412
Crider, A. P., 338
Crumley, J. A., 368
Curwen, M. D., 458

Danse, L. A., 437
Day, R. B., 433
Dearborn, R. J., 433
Delbridge, T. G., 434
Dietrich, K. R., 426
Dix, C. H., 351
Doladugin, A. I., 447
Dougherty, J. P., 414
Doynel, I., 421
Dreyer, W. C., 359
Dubrovai, K. K., 382
Dumble, W. H., 368
Du Pont de Nemours, E. I., & Co., 443

Easton, H. D., 339
Ebaugh, I. A., 436
Edson, F. H., 414
Eichengrün, A., 463
Englin, B. A., 447

Faingar, M. M., 451
Federov, V. S., 336
Fenske, M. R., 431
Ferguson, W. B., 334
Fields, J. D., 443
Fischer, F., 388
Fisher, R. P., 368
Fletcher, H. W., 384
Flores, L. de, 414
Fossa-Mancini, E., 342
Fox, C. R., 368

Gard, E. W., 412
Gary, W. W., 414
Gerasimov, M., 428
Gillespie, C. P., 368
Gilliland, E. R., 417
Gluzdenek, V., 385
Golyer, E. de, 346
Goodwin, N., 414
Gruse, A. V., 433

Haines, M. W., 368
Halbouty, M. I., 357
Hall, F. C., 442
Halpern, M., 418
Harrison, J. W., 414
Hausman, J., 449
Heiman, S., 413
Heinse, R., 419
Hetzel, T. B., 444
Hubner, W., 445
Hughes, J. D., 361
Hultin, C. T., 454
Hunter, T. G., 440

Ihrig, H. K., 386
Imperial Chemical Industries Ltd., 433
Ipatieff, V. N., 391
Ivanovsky, L., 402

Jakosky, J. J., 354
Johnson, A. E., 368
Johnson, J. Y., 453
Jones, C. C., 463

Kalichevsky, V. K., 433
Karasev, I. P., 371
Kauffman, H. L., 460
Keith, P. C., 429
Kepriianov, A. I., 390
Khadshinov, V. N., 392
Kise, S. A., 415
Kleinpell, R. M., 326, 327
Kolomatskii, D. Y., 435
Komarewsky, V. I., 391
Kroenig, W., 433
Kudryavtsev, P. A., 427
Kusner, T. S., 390
Kusnetsov, M. I., 353

Lacey, W. N., 389, 393
Lane, W. G., 368
Langleben, M. L., 364
Larin, A. Y., 432
Lauer, B. E., 454
Lavrovskii, K. P., 410
Leathercock, C., 325
Lebedenko, —, 366
Lederer, E. R., 443
Lee, A. R., 450
Leet, R., 415
Leibo, A. N., 409
Lerch, W. B., 372
Leupold, E., 467
Lewis, W. K., 404, 443
Logan, W. B., 418
Lohrengel, W., 426
Loving, G. H., 350
Luisenkova, E. S., 439

MacClatchie, J. W., 368
Machinskii, E. K., 365, 366
Mair, B. J., 387
Malishev, B. W., 430
Manley, R. E., 418
Mann, C. A., 454
Manning, A. B., 448
Manning, S. E., 368
Marder, M., 401
Marx, A. H., 340
Matthews, M. A., 433
Maurel, A., 394
McCarty, B. Y., 443
McCullough, I. J., 368
McCurry, J. R., 368
Meaker, F. L., 412
Mellersh-Jackson, L., 463
Miller, S. P., 453
Mills, B., 336, 337, 355, 370
Minton, J. W., 334
Mitchell, J. G., 450
Moresi, C. H., 329
Morrell, J. C., 433
Mott, G. A., 463
Mukhin, L., 428
Murphy, G. B., 445

Nash, A. W., 440
Neuhaus, R., 384

Obryadchikov, S. N., 412
Olszewski, S., 331
Oppenheim, V., 341
Ota, S., 446

Page, A. G., 412
Parson, L. G. B., 433
Pavlovskii, M. T., 397
Payne, D. E., 443
Pelzer, H. L., 414
Perry, W. C., 384
Peterkin, A. G., 414
Peters, E., 388
Petetier, L. A., 403
Phelps, M. W., 358
Pier, M., 433
Pines, H., 391
Pojarkova, A. I., 343
Polyakin, Y., 396
Potts, H. E., 415
Price, W. A., 335
Priestly, W. J., 405
Puchkov, P. V., 410

Quiggle, D., 431

Ragatz, R. G., 453
Ravikovich, A. M., 439
Resinous Products Chemical Co., 443
Rittmeister, W., 415
Roberts, D. E., 433
Rogers, F. M., 433
Rossaire, H. E., 347
Rose, B. L., 453
Rose, F. W., 387

Sage, B. H., 389, 393
Saijo, S., 425
Sawdon, W. A., 362
Schenck, H. G., 326
Schicktanz, S. T., 387
Schlumberger, C., 384
Schmidt, L., 383
Schulze, W. A., 433
Schweitzer, P. H., 444
Schweyer, H. E., 452
Sclater, K. C., 367
Scott, B. H., 384
Shaw, S. F., 375
Sheiman, A. B., 382
Simon, W., 433
Skelton, W. E., 443
Smiley, T. F., 420
Smith, G. H., 350
Smith, J. C., 368
Smull, J. G., 456
Snider, L. C., 333
Soc. des Etabl. Barbet, 433
Solodovnik, M. A., 447
Sorokin, N. A., 382
Southcombe, J. E., 400
South Metropolitan Gas Co., 415
Stagner, B. A., 457
Standard Oil Co. (Calif.), 463
Standard Oil Co. (Ohio), 443
Stanier, H., 415
Stapleton, V., 414
Starr, J. V., 443
Still, C., 414
Stockman, L. P., 363
Stratford, W. M., 433
Strigotskii, A. A., 365
Suiva, T., 424
Taylor, J. S., 368
Taylor, R. A. A., 448
Taylor, R. S., 456
Thayer, C. H., 412
Tobia, M., 395
Tongberg, C. O., 431
Tops, J. L., 403
Traxler, R. N., 459
Ullich, W., 418
Umpleby, J. B., 349
Veksler, Z. V., 427
Virobyants, R. A., 427
Wade, A., 323
Wait, J. F., 433
Wallis, J. S., 412
Ward, J. T., 429
Weber, B. V., 344
Wells, W. I., 368
Westby, G. H., 352
White, G. D., 414
Wickersham, H. P., 361
Wiggins, W. R., 442
Wilhelm, C. J., 383
Wilson, D. M., 398
Wing, H. J., 459
Winzer, K., 388
Woodring, W. P., 327
Wright, J. C., 368
Yamasaki, K., 446
Yonker, M. P., 433
Zaks, S. L., 382
Zhirnova, 425
Zinchenko, K. E., 391

Geology.

551.24]

323. New Theory of Continental Spreading. A. Wade. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1806–1812.—A modification of Gutenberg's theory is presented in order to meet some of the objections that have been advanced. Stated briefly, it is as follows. The original crust was sima, and the sial formed from this by oxidation, hydration, erosion, re-sorting and re-deposition as sediments. The water covering the crust would leave the poles, on account of the higher speed of rotation at that time and the shorter distance to the moon. The agencies forming the sial would thus be very active at the poles, and as soon as the sial sheets became thick enough and consolidated, the hydrostatic equilibrium would be disturbed and both sheets would begin to move. They would tend to move towards the equator, and would be affected by westerly drift as well as radial flow. The equatorial geosynclinal belt thus becomes the zone of contact between the two sial sheets, and the major geosynclines have similar origins. Evidence from the Australian area in support of this theory is considered in some detail. S. E. C.

551.24]

324. Structure Elements of Domes. R. Balk. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 51–67.—The similarity of structures developed in domes in sedimentary rocks, salt domes and dome-shaped igneous intrusions is discussed. The importance of the associated fractures in providing zones of movement for fluids is pointed out, and it is suggested that studies along this line deserve attention. S. E. C.

551.734 : 55(766)

325. Chattanooga Shale in Osage County, Oklahoma and Adjacent Areas. C. Leathercock and N. W. Bass. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 91–101.—The Chattanooga Shale is an extensive formation averaging 40–50 ft. in thickness and covering a large part of Oklahoma and Kansas. There is, however, an area on the N.E. border of Oklahoma, in Osage county, and extending into Kansas, in which the Chattanooga Shale is absent. The cause of this may be either non-deposition or erosion, there being insufficient data collected to show which hypothesis is correct.

There is some doubt as to its correct age, the U.S. Geological Survey classifying it as Devonian, whilst most Mid-Continent geologists consider it to be Mississippian. It rests unconformably on rocks which range in age from Ordovician to Devonian as one proceeds southwards and westwards from N.E. Oklahoma. At the base of the shale there is found locally a thin sandstone band known in some areas as the Misener sandstone. The Chattanooga Shale itself is a black, carbonaceous shale which is well jointed at its outcrops and weathers into thin flakes. It commonly contains nodules of pyrite, conodonts and plant spores. Above it is a sequence of grey shales and limestones sometimes referred to as the Kinderhook Shale and sometimes as the Mississippian Lime. There is a certain amount of interbedding of black and grey shale and,

as one passes northwards from Oklahoma, a decreasing thickness of black shale with a corresponding increase in thickness of grey shale. It is probable, therefore, that part of the black shales of N. Oklahoma are equivalent to the grey shales of Kansas.
S. E. C.

551.78 : 55(79)

326. **Refugian Stage of Pacific Coast Tertiary.** H. G. Schenck and R. M. Kleinpell. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 215–225.—It is proposed to establish a new stage, the Refugian, in the Tertiary of the Pacific Slope. It includes those sediments deposited after the Tejon formation and before those of the Zemorrian stage. It is probably equivalent to a portion of the Upper Eocene or Lower Oligocene of Europe. Evidence relating to this division has been collected in Washington, Oregon and California, and the palæontological details are discussed. There is as yet insufficient evidence concerning the base of the stage below the Refugian to allow it to be satisfactorily defined.
S. E. C.

551.782.1 : 55(794)

327. **Miocene Stratigraphy and Palæontology of Palos Verdes Hills, California.** W. P. Woodring, M. N. Bramlette, and R. M. Kleinpell. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 125–149.—The Palos Verdes hills are on part of the S.W. side of the Los Angeles plain. They are formed principally of Miocene rocks, of which hard, porcelaneous and cherty shale and soft shale with siliceous micro-fossils are conspicuous constituents. It is proposed here that these Miocene rocks should form the Monterey formation, which, in the region considered, is divided into 3 members. There are 5 main lithologic types, viz. silty shale, porcelaneous and cherty shale, phosphatic shale, diatomite and radiolarian mudstone.

The first three lithologic types are representative of the Altamira shale, which has a thickness of over 1000 ft., and is the basal member of the Monterey. Six zones can be distinguished on the basis of evidence from foraminifera. Above the Altamira shale lies the Valmonte diatomite. Its base is difficult to distinguish. It is mapped according to the abundance of diatomite, but this is variable. Two zones can be distinguished by their foraminifera content. The uppermost member is the Malaga mudstone. It is a massive mudstone in which radiolaria are abundant and diatoms common.
S. E. C.

551.782.1 : 55(794)

328. **Age and Correlation of Schist-bearing Clastics, Venice and Del Rey Fields, California.** W. H. Corey. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 150–154.—The strata here considered are the sands and conglomerates which rest on the schist and below the nodular Upper Miocene shale in the Venice and Del Rey fields. A search of all available cores revealed an Upper Miocene molluscan fauna equivalent in age with Hoots' basal Modelo graywacke of the Santa Monica mountains. The following conclusions were reached. The nodular shale is conformable with the sand and conglomerate. A large area of schist emerged during Vaqueros and Temblor times, whilst uplift of a smaller area in the Venice district continued into Upper Miocene time. This smaller uplift ceased when general erosion of the schist ceased and deposition of the shale commenced. The Vaqueros–Temblor land mass extended west of the Inglewood rift zone from the Santa Monica mountains to the south side of the Palos Verdes Hills.
S. E. C.

551.482.1 : 55(76)

329. **Warping of Formations Along the Gulf Coast.** C. K. Moresi. *Oil Weekly*, 10.2.36, **80** (9), 48.—The physiography of the Mississippi delta and coastal marshes is changing rapidly, and not only does the delta grow outwards; it also grows downwards, the down-warping due to the load of sediments not being restricted to the area of the delta, but involving a large marginal area in addition. As the landward margin of the most active geosyncline in North America, an extensive absolute gravity survey would be of great value.
G. D. H.

553.631 : 553(763)

330. Late Recent History of Cote Blanche Salt Dome, St. Mary Parish, Louisiana. D. C. Barton. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 179–185.—The Cote Blanche dome rises 100 ft. above the coastal marsh, whilst the salt reaches a maximum height of 350 ft. below sea-level. A sink-hole, of recent origin, in the south part of the mound is occupied by Read Lake. Actually two sink-holes were formed during recent times, and the low specific gravity of the alluvium in these holes suggests that they are of late origin. It is concluded that the solution causing the holes started while a low mound was present. During the renewed uplift the central hole with its filling rose and formed the present mound. There is no sign of further solution in this case. Solution seems to have been continuous, however, in the case of the second sink-hole, and possibly is still active. There is no conclusive evidence of the formation of residual cap-rock due to this solution. S. E. C.

553.982 : 553(438)

331. Oil and Gas Shows in West Poland. S. Olszewski. *Petr. Z.*, 1.1.36, **32** (1), 1–8.—Shows of oil have been reported from time to time in West Poland. The most important occur in a zone 420 km. long and stretching S.E. from Tuchola-Waldungen in Pomorze to the river Wisla in the neighbourhood of Stopnica and Wislica in Kielce. The more important shows occur as follows.

Kcynia, near Szubin, Poznan. Oil, sp. gr. 0·88 and 88% distilling at 360° C., noticed on ponds in May 1934, 50 litres collecting in a few days. Gas, smelling of H_2S, met while digging a ditch near the pond. Water in a well not far distant has a high content of alkali sulphates, chlorides and carbonates.

Tuchola, Pomorze. Oil, sp. gr. 0·83 and containing up to 85% kerosine, found on water in a well after deepening. Similar oil in a ditch and pond near by and accompanied by gas with 28% methane and 64·5% nitrogen. Shows also reported 2 km. west of Tuchola in a boring 230 ft. deep.

Inowroclaw, Posen. Bituminous salt, with shows of oil and gas, on the edge of a salt stock—previously known as the Hohensalza salt mass.

Janiszewo, Warszawa. Shows of light oil in the Wealden at 126 m. and warm, salt water with H_2S at 325 m. Shows of similar oil reported from Brzyszewo, Warszawa.

Biskupice, near Radziejow, Warszawa. Shows of light oil, 90% distilling 216–300° C., in the village springs. Possibility of leakage from barrels considered and rejected.

Zalodza, near Wojcza, Kielce. Oil collected from village fields and used by peasants as lubricant. The shows are in clayey sands (Tortonian). Two borings in 1884–5 gave shows in the chalk marl (Turonian), but only 4500 kg. of oil were obtained. From 1929 to 1931 a number of test borings were made, depths varying from 40 m. to 445 m., with not more than shows, also in the Turonian marls. The oil is dark, sp. gr. 0·914, smells strongly of H_2S, and is similar in occurrence to that at Heide in Holstein.

Leszno, Znin and Brodnica. Bituminous gypsum with small shows occurs in the Miocene.

Kielce and Opatow. Slightly bituminous zones are found in the mid and upper Devonian limestone.

Sendzin, Warszawa. Oil, sp. gr. 0·837 and 94% distilling between 178° C. and 300° C., collects on water in the springs. Genesis doubtful, possibly due to leakage.

S. E. C.

553.982 : 553(73)

332. Petroleum Production and Supply. Report of a Committee of the American Petroleum Institute. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 1–14.—A special committee of the American Petroleum Institute has been formed to report on the petroleum resources of the United States. These are divided into 3 groups: the supply held in overground storage; that held in underground storage in pools discovered and partly developed; and the future reserve which is in pools as yet undiscovered.

Stocks held in overground storage represent several months' supply, and in 1934 were of the order of 300–350 million barrels.

Estimates of proven underground reserves are based on the current methods of production at current prices. They were calculated to be 12,177 million barrels at the beginning of January, 1935. It is estimated that an additional 1,250 million barrels

were added to the proven reserves during 1935. It is shown that the discovery of new reserves has always proceeded at a greater rate than production.

There is no method known for the estimation of future reserves. Methods of prospecting have been vastly improved in late years, and depths of drilling greatly increased, so that the present prospect of discovering new reserves is better than previously. Production methods have also been greatly improved, so that a higher recovery may be expected. In general, it may be said that there is no indication of any imminent danger of shortage.

The coal and oil shale deposits are of such a magnitude that they could serve as sources of oil for a long period should the reserves of natural petroleum become limited.

S. E. C.

553.982 : 553(73)

333. Probable Petroleum Shortage in the U.S.A. and Methods for its Alleviation. L. C. Snider and B. T. Brooks. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 15–50.—The term "shortage" is used here in the sense of being unable to meet current demand at prices not appreciably higher than those prevailing to-day. In the study of this subject the following factors are outstanding. About 50% of the petroleum produced at any time comes from flush wells amounting to only 2% of those in production at that time. From a consideration of decline rates and of rates of consumption, it is estimated that during the 10 years 1935–45, 3275 million barrels of new production must be discovered, the equivalent of the entire Texas production to the end of 1933. Only 3 states, Arkansas, New Mexico and Montana, have been added to the list of productive states in the past 25 years, and these have not proved to be important. The new production of importance has been due to improvements in drilling and prospecting which have permitted deeper drilling in and about the already proven areas. California, Texas and Oklahoma have yielded 70% of the total production, and have more than 80% of the proven reserves, and, furthermore, appear to hold the most promise of new fields. Maintenance of production depends on the discovery of large fields, 48 such fields having contributed 57% of the total production to the end of 1934. A consideration of such points leads to the conclusion that there is a possibility of shortage as early as 1940 and a probability of considerable shortage by 1945.

Methods of increasing production such as water flooding, gas drive and mining promise to be of value in alleviating shortage, but will be a minor factor in preventing it, on account of their cost. Substitutes for petroleum may be found in oil shale and in coal. Large-scale development of such substitutes cannot be considered, however, until the shortage is definite and not temporary, so that the price of petroleum products is permanently raised. Whilst any possibility of finding new, large pools remains, such projects are questionable. At present the consumption of gasoline is the dominating factor. A change from gasoline to diesel oil for automobiles would be stimulated by shortage, and would tend to alleviate its effects. S. E. C.

553.631 : 553(764)

334. Clay Creek Salt Dome, Washington County, Texas. W. B. Ferguson and J. W. Minton. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 68–90.—The Clay Creek dome is 22 miles N.E. of the Brenham dome. It was first discovered in 1926 by surface mapping, and production was first obtained in 1928. By May, 1935, 77 wells were completed, of which 36 were oil wells and 5 were gas wells. Initial productions from 100 to 6800 brl. were obtained at depths from 1225 ft. to 1560 ft. The producing sands are in the Yegua, Cook Mountain, Mount Selman and Wilcox formations.

Surface mapping shows the structure to be that of a dome with its centre depressed and covering an almost circular area of 4 miles diameter. Subsurface information has been obtained by extensive coring, correlation being by micropalæontological methods. Structural "highs" exist on both the south and, to a lesser degree, on the north side of the dome, the S.E. side of which dips steeply away. A torsion balance survey showed an abrupt falling off on the N.E., N.W. and S.W. sides. There is a decided thinning of the cap-rock on the sides as compared with the centre. Cavities of as much as 7 ft. have been found between the calcite and the anhydrite in the cap-rock and salt water from these cavities shows a higher temperature towards the centre of the dome.

Three radial, scissor faults extending outwards from the centre of the dome have been proven on the S.E., S. and S.W. sides. The uplift began in pre-Wilcox times and continued until the end of the Jackson. The uplift was apparently constant until mid Wilcox times, and then relaxed somewhat until the end of the Wilcox. The result of this was a settling of the central area. Renewed activity then took place, resulting in further irregular uplift until the end of the Jackson, when movement ceased. S. E. C.

553.982 : 553(764)

335. Faulting Plays an Important Part in South-west Texas Coastal Region. W. A. Price. *Oil & Gas J.*, 13.2.36, **34** (39), 11.—Gas production in this area dates from 1913, but it was not until 1930 that oil was found in the Oligocene on a dome near Houston. Since that time further drilling has proved the presence of numerous areas of production. Recent investigations have proved the presence of faulting in several of the fields. In the Saxet field, for instance, four fractures trending N.E.–S.W. with dips of from 45 to 60° have been found. In other fields the faults are said to be numerous, and complicated by cross-faulting, and in some cases the throw is as much as 350 ft. This makes it difficult to correlate the producing horizons in one well with those of another a few miles away.

Until further geophysical work has been done, it cannot be decided whether faulting is the primary factor governing accumulation, or if the presence of dome structures also plays a part. There are several producing sands, mostly in the Oligocene, and even if a well finds one sand dry it may, because of the low angle of the faults, find production below the fault-plane in another sand. J. A. G.

553.982 : 553(764)

336. East Texas Ranks High. B. Mills. *Oil Weekly*, 17.2.36, **80** (10), 17–25.—Five years of intensive development have proved an unbroken and almost uniform producing area more than 44 miles in length. There are about 20,000 producing wells, of which 17,000 flow naturally. The allowable daily production is 432,264 brl. at present, and most of the total of 800,000,000 brl. produced has been obtained under curtailment.

The water line along the greater part of the western boundary was defined in the early stages. Salt-water encroachment is giving trouble in this region, and at the beginning of 1936, 1200 wells were making some salt water. The eastern boundary seems to feather out irregularly, the sand thickness being much less than in the inside leases, but water is absent. The northern boundary has been extended more than 3 mls. beyond the original supposed limit, the wells giving satisfactory production. Production is from the Woodbine sand, which has given an ultimate recovery of 800–1200 brl./acre-ft. in other fields. The average porosity is 25%, and the average sand thickness is 40 ft. The recoverable oil is estimated as 40% of the oil in place, with a shrinkage factor of 87%. A conservative estimate gives the total area of the field as 127,000 acres, from which the total recovery, using the above factors, is calculated as 3,480,000,000 brl. of oil.

The original bottom-hole pressure was about 1600 lb./sq. in., but now the average is a little under 1200 lb./sq. in. On the east and south-east flanks it is only 700–800 lb./sq. in. Now the pressure decline is very gradual.

The sand thickness ranges from a few to over 100 ft., and it thickens gradually towards the long centre strip. The highest recognised potential is over 1000 brl./hr., but the average allowable per well is only 21·6 brl./day, with a minimum allowable of 20 brl./day. The average depth to the top of the oil sand is 3631 ft.

The East Texas field is producing about 16% of the United States' total. Its life is given as about 15 years under present conditions. The crude is mixed base, and the gas–oil ratio is low, being about 400 c. ft./brl. G. D. H.

553.982 : 553(764)

337. Rodessa a Big Reserve. B. Mills. *Oil Weekly*, 10.2.36, **80** (9), 28–34.—The Rodessa field is in north-west Louisiana and north-east Texas. It is a long, narrow producing zone with a major fault influencing accumulation over the entire length. Some think that the field may extend into Arkansas, or that there will be another field along the same line. Oil accumulation is restricted to the upthrown side of the

fault. The productive horizon is in the top of the Lower Glen Rose (Lower Cretaceous), which also carries gas in several north-west Louisiana fields. Oil is obtained from a belt extending 450 ft. down dip from the highest point of the structure where the fault occurs. Gas only is found at the top of the structure.

The field is about 6 mls. long, and 1 ml. wide, having 70 wells which have proved an area of 4500 acres. The best production is from a depth of 6000 ft. The limestone has a high porosity, but no extended fissures, breaks or pockets have been met. The maximum thickness of the productive horizon is 53 ft.

The estimated average recovery is given as 25,000 brl./acre. Some believe that the field will ultimately cover 10,000 acres. Two bottom-hole pressure tests gave 2740 lb./sq. in. The average pressure decline is low. The water level is not uniform, and appears to be lower on the outside flank.

The lower third of the Lower Glen Rose consists of oolitic limestones and shales, and showed oil and gas in one well. This part of the formation has distinct possibilities, and the Red beds below the Glen Rose are also viewed favourably.

G. D. H.

553.982 : 553(764)

338. Rodessa is Two-State Pool of Immense Potentiality. A. F. Crider. *Oil & Gas J.*, 5.3.36, **34** (42), 11–12.—The structure of the area is that of a plunging anticline faulted parallel to the strike, the throw being 600 ft., with the up-throw on the down-dip side of the fault.

At Rodessa the massive anhydrite, about 600 ft. thick and of Glen Rose age, is used as an arbitrary horizon to divide the Upper and Lower Glen Rose. Production is from four sands below this anhydrite. The top two, the Hill and Gloyd, produce only gas. The lower two, the Dees and the Young, are also gas sands near the fault, but about 200 ft. down-dip are oil-bearing. It is thought that the Hill and Gloyd sands may eventually prove oil-bearing in parts of the structure yet to be tested.

Comparison of well logs from Rodessa and Pine Island show great differences in the sequence. In the latter field the Paluxy Red Beds and the Upper Glen Rose have been entirely eroded, and the Upper Cretaceous rests directly on the truncated edges of the Glen Rose Limestone, about 200 ft. above the anhydrite. This feature results in the base of the anhydrite being about 2600 ft. deeper in Rodessa than in Pine Island.

Owing to the fact that there are four distinct producing horizons extending over a vertical distance of 360 ft., the width of producing territory is much greater than in any other known fault-field. Evidence available at the moment leads to the conclusion that the field will extend from Rodessa to beyond Lodi, and in length will at least equal East Texas.

J. A. G.

553.982 : 553(764)

339. Rodessa Indicates Lower Cretaceous Shore-line Possibilities in Arkansas. H. D. Easton. *Oil Weekly*, 2.3.36, **80** (12), 19–24.—Rodessa has opened up a new oil horizon in the Glen Rose middle member of the Trinity series of the Lower Cretaceous. There has been a recent discovery of gas in the Glen Rose in Lincoln Parish, and a new deeper Glen Rose horizon of saturated gas in the Sligo field of Bossier Parish. Northern Titus County, 70 mls. north-west of Rodessa, has good prospects of making an oil-field in the Lower Cretaceous at a depth of 4208 ft. This latter is north of the Tyler basin, opening a new petroliferous province beyond the Rodessa syncline.

At Rodessa production is from the oolitic lime—the Hill, Gloyd, Dees and Young "sands"—beneath the Glen Rose anhydrite. The Hill "sand" gives gas from depths of 5260–5485 ft. The Gloyd is about 110 ft. deeper, yielding oil and gas. The Dees is 100–150 ft. below this. Altogether nine fields in this area are now producing oil or gas from Glen Rose oolitic beds and quartz sands.

In addition to the discovery of new fields on localised structures, there are three shore-line possibilities. Two of these are to be found on the north and south flanks of the north-east Louisiana or Monroe uplift, which, on its northern flank, offers a number of possible producing horizons from the Midway down to, and perhaps including, the Palæozoics on advancing into the Arkansas syncline. To a less extent the southern flank is of interest, possibly from the Claiborne downwards.

Just north of Rodessa is a saddle, to the west and south-west from which the beds

plunge gradually into the Tyler basin. To the east they flatten out into a broad terrace. A basement (Palæozoic) fault runs E.–W. through Hempstead county, Arkansas. There is probably folding or faulting in the Trinity beds at this point which would permit migration of oil from the Palæozoics, which Ver Wiebe considers as a likely source rock. This Palæozoic fault or steep flexure is known from well evidence to lie south of Saratoga. This feature is mainly the result of movement at the end of the Comanche period, for the oldest known Cretaceous sediments do not extend north of it, and the Travis Peak formation decreases in thickness over it.

Whilst there has been little deep drilling in this area, it is fairly well established that the Lower Trinity has excellent bodies of quartz sand. Also, south of the Palæozoic break there is a much greater thickness of Lower Cretaceous than is seen at the outcrops. It is possible that there are deeper sand bodies terminating against this Palæozoic break, and so constituting shore-line traps. G. D. H.

553.631 : 553(784)

340. Hoskins Mound Salt Dome, Brazoria County, Texas. A. H. Marx. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 155–178.—The first tests were drilled in 1903–4, but without result. The first production was obtained in 1905–10 from sands above the cap-rock. From 1915 to 1922 a number of wells were drilled, 4 being deep flank tests. A small amount of oil was obtained, and also proof of a large deposit of sulphur in the limestone above the anhydrite. This sulphur deposit has been the main centre of operations, and more than 4,000,000 long tons have been mined by the Frasch method.

The salt dome is indicated at the surface by a low mound rising about 25 ft. above surrounding land. The surface strata are yellow, Beaumont clays containing calcareous nodules. Some subsidence has occurred due to the removal of the sulphur. The cap-rock consists of anhydrite at the base, followed by sulphur-bearing limestone, and finally barren limestone. Above this are unconsolidated marls, sands and clays ranging in age from Mid-Oligocene (?) to Recent. The barren limestone is light and dark grey in colour, and more or less porous. It also contains small amounts of sulphur, which increase in the true sulphur-bearing limestone. It occurs there in bands up to an inch or more in thickness. Celestite is common. The anhydrite completely covers the top of the plug and extends some distance down the flanks. There is little evidence concerning the age of the dome.

It is estimated that the total oil production has not exceeded 500,000 brl. Practically nothing is known concerning possibilities of the lateral beds abutting the dome.

S. E. C.

553.982 : 553(814.2)

341. Petroleum Geology of Gondwana Rocks of Southern Brazil. V. Oppenheim. *Bull. Amer. Assoc. Petr. Geol.*, 1935, **19**, 1725–1805.—The paper is divided into two parts, each with a full bibliography. The first part deals with the geology of the region and its relation to the Gondwana system, whilst the second refers particularly to petroleum occurrences and prospects. The area described is the Paraná Basin, bounded on the east by the Archean complex of the Serra do Mar and on the south and west by the Serra Geral.

The base of the Gondwana system in Brazil is formed by the Itararé series, which are of glacial origin and composed mainly of heterogeneous sandstones. Their thickness is variable, in certain areas it may be as much as 1000 metres. With the exception of the State of Paraná, where it rests on the Devonian, the Itararé rests on granite and metamorphic rocks. No signs of folding were observed, such dips as were seen being apparently due to igneous intrusions. However, well cores suggest faults of considerable horizontal development in some areas. Palæontological evidence concerning the age of the Itararé is meagre, and until more is available a Permian age is assumed.

Resting conformably on the Itararé is the Tubarão series, which is divided into two groups, the Rio Bonito and the Palermo. The Rio Bonito group consists of sands and dark shales with coal measures, whilst the Palermo consists of grey shales with sandstone bands. The series is fluvial, probably estuarine, and again shows no sign

of diastrophism. A Permian age for these sediments seems certain. They rest, apparently conformably, on the Passa Dois series, which is divided into three groups. The two lower groups, the Iraty and the lower Estrada Nova, are placed in the Permian, whilst the upper Estrada Nova is placed in the Trias. The Iraty group consists of black, bituminous shales with thin limestone bands. The bitumen content may be as high as 10% by volume, and the group forms an excellent key-bed for structural mapping. The overlying lower Estrada Nova group also consists of black shales, but they are non-bituminous. The upper Estrada Nova group differs in that it is composed of coloured, sandy shales with sand-beds, the upper part being more clayey than the lower, and showing great horizontal variation.

The São Bento series is likewise divided into three groups, viz. the Rio do Rasto, the Botucatú sandstone, and the Serra Geral eruptives. The Rio do Rasto comprises a series of coloured sandstones resting unconformably on the upper Estrada Nova group. It is separated from the Botucatú sandstone by a local angular discordance, although it is otherwise difficult to distinguish between them. These sediments and the Estrada Nova are terrigenous in type. The Serra Geral eruptives cover a great area in Brazil, Uruguay, Argentina and Paraguay, and are a very important development physiographically. They are basaltic in type with very uniform composition, and are probably the result of successive and quiet flows with ejections of very fluid lava. The flows probably commenced in the upper Trias and continued till the Lias, with a maximum development in the Rhaetic.

From the point of view of structure the Paraná Basin is a geosyncline with a N.E.–S.W. axis and characterized by fault blocks "en echelon" from east to west. The steps are of relatively small displacement. In the south a monocline is developed on the eastern margin with the blocks resting on the Serra do Mar.

In the section dealing particularly with petroleum the evidence concerning occurrences in the Gondwana rocks in the southern hemisphere, with the exception of Brazil, is first examined. It is shown that commercially exploitable oil deposits are unknown in those areas. Brazil is then considered in more detail. The Iraty group is the only formation which can be considered as a source rock, the sediments above and below being deposited in environments unsuited to petroleum formation. Shows occurring in those sediments are from material derived from the Iraty. There is evidence of intense thermal metamorphism, and it is suggested that this was the cause of the formation of the bitumen and asphaltic petroleum. There is no evidence of large-scale migration and accumulation in overlying sediments, in spite of favourable structures, and it would thus appear that the organic material originally present was unsuitable for the formation of large quantities of petroleum.

The author concludes that these bituminous shales form a valuable reserve which could be worked under favourable economic conditions, but that prospecting for oil-bearing structures should be directed to the Cretaceous and Tertiary sediments and, probably, also the Devonian. S. E. C.

553.982 : 553(82)

342. The Faults of Comodoro Rivadavia in the Petroliferous Strata and at Outcrop. E. Fossa-Mancini. *Bol. Inform. Petroleras* (*B.A.*), Dec. 1935, **12** (136), 65–95.—Academic instruction with reference to faults is far too limited, in view of their fundamental importance in geological work, and geological text-books in general treat this subject much too cursorily. The student is thus left with the impression that faulting is a catastrophic phenomenon, whereas in reality the majority of faults have been active throughout long geological periods, and are comparable with an open wound in the earth's crust. It is rarely that a fault-break has become firmly cemented.

Faults may be divided, as are volcanoes, into active, passive and extinct. Already the expression "active fault" is in current use, by geologists who work in seismic regions, to describe faults along which movement is actually occurring.

The faults of the Comodoro Rivadavia field have been the subject of several papers in the past, and it is now recognized that they have played a predominant part in the accumulation of petroleum. It is also admitted that faults of small throw at the surface are related to big displacements within the petroliferous strata.

The geological history of Comodoro Rivadavia may be summarized, in the opinion of the author, as follows :—

The late Triassic period, in that part of Patagonia under review, was characterised by great volcanic activity, and numerous eruptions covered the ancient basement with a thick series of lavas intercalated with ash. The basement was composed largely of crystalline rocks, which must have suffered severe fracturing to permit the passage of the lavas from below. We know nothing of the topographic character of the Triassic topography, but we may assume that it was of a broken nature.

During Jurassic and early Cretaceous times the ocean invaded the Triassic land of Patagonia from the west, but does not appear to have reached the Comodoro area, which remained dry and underwent a considerable erosion of the Triassic material.

In middle Cretaceous times the Comodoro Rivadavia area was a low-lying flat, and the deposits formed were, normally, of a continental character. Occasional inundations, however, caused the deposit of foraminiferal estuarine beds. The great thickness of the continental beds, proved in the deepest wells, suggests long-continued land conditions during this period, which extended well into the Upper Cretaceous.

What was possibly the end of the Cretaceous was marked by the Salamanquian transgression from the east, accompanied by considerable movement along faults. The marine beds laid down during this transgression are of practical importance, as they contain a good marker-horizon.

The transgression was followed by a retreat of the sea and a recurrence of continental conditions which gave rise to the "Pehuenche" sands and shales. The beginning of this period was marked by stability, but movements along fault planes occurred later.

Oligocene and Miocene times were marked by submersion and the deposit of marine beds caused by a new invasion of the Atlantic (the Patagonian ingression). In the lower beds of this marine series faults with throws varying from decimetres to some metres may be observed, while in the upper beds no faulting is found, but it is replaced by sudden and limited changes in dip from the normal horizontality.

The upper Tertiary was marked by a land phase, first with a dry climate giving rise to great thicknesses of continental beds (Araucano formation). This was followed by a wet climate, during which period river deposits were laid down. The upward movement has continued, with interruptions, to the present, and the rivers have excavated great terraced valleys, and have covered part of these terraces with recent gravel deposits.

The faults of Comodoro Rivadavia can be divided into two main series which run, approximately, N.–S. and E.–W. These faults divide the petroliferous beds into blocks of moderate horizontal extent, not uncommonly as little as 3 or 4 hectares, and rarely exceeding a square kilometre.

In the old zone of the Fiscal Reserve, the Cretaceous beds dip in general northwards, and the E.–W. faults are downthrown to the south. In the south part of the Reserve the general dip of the Cretaceous beds is to the south, while the E.–W. faults downthrow northwards. The general character of the faulting is illustrated by 4 sections and a block diagram.

10 pages (82–92) are devoted to an illustrated exposition, academic, but with original features, of the effects of active faulting on the thicknesses of strata deposited during movement. The complications arising from the crossing and branching of faults are also dealt with.

At Comodoro, the producing beds (upper part of the Chubutian and base of the Salamanquian), as well as the formations above them, consist essentially of pervious sandy beds and of impermiable beds of clays and fine tufas.

The circulation of fluids in these beds may be attributed, very largely, to pressure from fault movements, to porous breccia material and to cavities caused by faulting. A probable explanation of the genesis of these cavities is movement along fault surfaces which hade at varying angles, with reference to the bedding planes, according to the physical properties of the strata they pass through.

To summarize:—A faulted area, such as Comodoro Rivadavia, should show: (1) considerable variations and irregularities in the thicknesses of beds laid down during periods of active fault movement; (2) diminution of the throw of any one fault as the stratigraphical column is ascended; (3) open faults grading upwards into perfectly sealed faults.

The paper ends with suggestions as to the study of faulted areas. It is illustrated by 15 figures, including 4 maps. L. O.

561

343. **Paleobotanical Symposium.** A. I. Pojarkova. *Trans. Petr. Geol. Res. Inst., Leningrad*, 1935, Series A, Paper 39.—*New Contributions to the Tertiary Flora of the Northern part of the Circumaralian region.*—Descriptions, illustrated by 10 photographs, of fossil leaves. 16 species have been identified, 11 of which have already been reported in the deposits of the Tourgai region. One species of oak, *Quercus Alexeevii*, A. Pojark, appears to be new to science.

Tertiary Flora of the Tenghi and Kadyk–Birakan Rivers (Western Part of Sakhalin).—Descriptions of 12 species, illustrated by 20 photographs.

The Discovery of a Fossil Flora of the Dui Age on the Eastern Shore of Sakhalin.—Descriptions of 14 species, representing the first flora identified from Eastern Sakhalin. Two species of the genus *Myrica* may be of use for correlation. One of these, *Myrica sachalinensis* sp. n., and a species of *Nelumbium*, named by the author *Nelumbium pacificum*, are new. L. O.

912 : 55(479)

344. **Detailed Geological Map of the Apsheron Peninsula, Range 11, Sheet 3 (Novkhany).** B. V. Weber. *Trans. Petr. Geol. Res. Inst., Leningrad*, 1931–34, Series A, Paper 32.—A pamphlet of 89 pages, in Russian, illustrated by 7 figures and containing a summary and generalized section in English.

The accompanying map and sections are drawn to the scale of 250 sajenes to the inch, or 1 : 21,000, and are clearly printed in colours on these loose sheets. The folder containing the sheets has on it an index map and descriptive matter, in Russian and English.

A large part of the solid geology of the area is masked by almost horizontal Quaternary deposits, which form a series of terraces separated from one another by pronounced scarps. The terraces rest, in sharp angular unconformity, on the eroded surface of the underlying folded Tertiary beds.

The area under consideration includes three pitching anticlines the major axes of which trend N.W.–S.E. Asymmetry is marked, the steeper dips occurring on the S.W. limbs, with occasional overturning. Overthrusting is observable on the N.E. limb of the central (Ordjan-dag) fold, in which the Pontian strata are overlain by older formations. The exposed beds range in age from Maikop–Oligocene to Recent.

Indications of oil occur on the Ordjan-dag and Fatmai anticlines, in the first case in Suite V of the Productive (Pliocene) series, which immediately overlies the Pontian, and, in the second case, in suites V, IVc and IVb of the Productive series.

Two of the wells drilled (Nos. 8 and 21) flowed, with a yield of 4–5 tons daily of oil of sp. gr. 0·925. L. O.

Geophysics.

550.83 : 55(76)

345. **Geophysics of the Gulf Coast. (Account of Ten Years' Application.)** P. Charrin. *Rev. Petr.*, 1936 (671–672), 321, 353.—The scanty superficial evidence of the existence of salt domes, covered as they mostly are by quaternary and tertiary slightly consolidated beds, leads to attention being directed to the difficulties of geological exploration, relying on surface evidence, and to the ideal conditions for a test of geophysical methods thereby afforded. Apart from a few slight topographic elevations and occasional seepages, no indications of the salt domes are superficially found. The distribution of domes follows no regular laws. They vary in size from a greatest diameter of ½ mile to 6 miles. The depth of the top of the salt masses varies from the surface to 2000 or 3000 metres in depth. Massive salt transmits the elastic waves with a speed of 5000–6000 metres a second, the surrounding lightly consolidated sediments give speeds not exceeding 3000 metres. Very deep salt masses (below 2000 metres) are revealed by a minimum of gravity compared with the denser sediments at depth. The history of the introduction of the torsion balance, followed by the seismic method (the refraction method being replaced by the reflection), is traced, and then a review of the actual geophysical work on the Gulf Coast for 10 years until the end of 1934 is made, geophysics having been "born" into the industrial life in 1924. The rapid progress in the United States and the very slow adoption of geophysical methods elsewhere are attributed to the peculiar conditions on the Gulf

Coast, where there were no means of discovering the buried structures except by wild-catting, until geophysics came to the aid of the geologists. Spindletop inaugurated in 1901 the commercial discovery of oil in the Gulf Coast region, and by 1923, 28 proved or possible fields in Texas and 17 in Louisiana had been discovered without any geophysical work. An annual record of the discoveries of new fields shows a decline in the numbers from year to year, and a geologist stated that during some years following 1916 the wild cats drilled numbered 675, cost $20,000,000, and discovered one solitary dome. In 1923 it did not seem that the gamble of wild-catting was any longer economically possible.

In the 11 years following, to the end of 1934, there were 9 new discoveries in Texas and Louisiana, made without direct geophysical methods, although in 3 geophysics played a small part. In these 11 years there were 69 domes or fields discovered by geophysical methods in Texas and Louisiana, about 7½ times as many as the non-geophysical discoveries. Geophysics also played a part in the development of fields already known, whereby the production had been brought up from insignificance to importance. Many prospects have also been discovered (120–130), and of these supposed prospects in 1934, it is estimated a minimum of 40 should be oil-fields in years to come. Thus a comparison is made between the 69 + 40 roughly 110 proved and possible fields discovered by geophysics in 11 years and the 45 + 9 discovered by the old methods in 31 years. Then the geophysical and non-geophysical fields are listed in 3 categories :—1. Fields producing in 1934 over 100,000 brl. 2. Fields with a small production. 3. Non-producers.

In 54 non-geophysic fields there are 29 in category 1, or 53·5%; 14 in category 2, or 26·0%; and 11 in category 3, or 20·5%. In 69 geophysical fields there are 23 in category 1, or 40·5%; 24 in category 2, or 35%; and 17 in category 3, or 24·5%. Two tables are given showing the number of years of exploitation, average production per year, total production, areas in acres, and finally the total averages of 12 geophysical and 12 non-geophysical fields. It is then argued from the figures, methods of control, defined acreage and the much shorter average period of exploitation that the geophysical fields compare very favourably with the older methods fields, and that at the end of 1934 it was reasonable to calculate that the geophysical proved fields, together with the prospects, should be capable of producing a total of 2000 million brl. The financial aspect of geophysics is finally discussed. The total of geophysical expenses on the Gulf Coast to the end of 1934 is given as $40 millions. The geophysical fields have produced 102,023,000 brl. of oil at an average value of $1 a brl.—say $100 millions. $75 millions is added as the cost of drilling 1823 wells and $5 to $10 millions for land purchase, etc. A total expenditure of $120 to $125 millions. $100 millions of this has been already recovered, and it is calculated that on the 2000 million brl. of oil to be eventually recovered from these geophysical fields, the geophysical cost will be only 2% of the total created value.

The activity of geophysics on the Gulf Coast is shown by there having been 86 geophysical equipments in operation at the end of 1934, and a footnote states that at the end of 1935 there were 95 equipments working on the Gulf Coast area.

B. F. N. M.

550.83 : 553.982

346. Notes on the Early History of Applied Geophysics in the Petroleum Industry. E. De Golyer. *J. Soc. Petr. Geophysicists*, 1935, **6**, 1.—Difficulties of prospecting for new salt domes in the flat Gulf Coastal plains of Texas and Louisiana and in the Isthmus of Tehuantepec, Mexico, were responsible for the author's introduction to the use of applied geophysics. In 1914 he first learnt of the Eötvös Torsion balance, a robust development of the delicate Coulomb balance used in laboratories since the eighteenth century. The first primitive instrument was finished in 1890, and Eötvös produced the present-day double beam in 1902, enabling the interpretation of buried regional geological structure by recording gravity anomalies, and Eötvös believed that small structures could be mapped by torsion balance surveys. In 1917–1918 Hugo von Boeckh, E. W. Shaw and Schweydar recognized the assistance which the instrument would give to geology. In 1919 the late Dr. Th. Erb pronounced the method to be theoretically sound.

The author, on account of Amerada-Mexican Eagle interests, acquired 2 instruments

in September 1922, and their first survey—of the Spindletop Dome, Texas—appeared to be most successful, although afterwards it seemed to have been rather a lucky accident, as Spindletop was found to be a definite gravity maximum. In the same year the Anglo-Persian and Dutch Shell groups were experimenting with this geophysical method in other countries. After several indefinite results in other surveys, the first geophysical prospect proved in the U.S.A. was the survey and successful well of the Nash area, Texas, probably the first oil pool disclosed by geophysical methods in the world.

In 1922 an unsatisfactory attempt was made to define the extensions of the buried Tomasopo ridge (Mexico) by refraction seismic surveys. Until 1924 the seismic method had not been of any practical value. In 1924 a Mintrop crew discovered the Orchard dome in Texas, the first seismic crew on the Gulf Coast and possibly in the world. The evolution of the seismic method from mechanical to electrical seismographs is described, and leads the author to direct attention to Robert Mallet, one of the fathers of seismology, quoting extracts—with regard to subsurface geology—from Mallet's "On the Dynamics of Earthquakes," *Irish Acad. Trans.*, XXI, p. 50, Dublin 1850, and extracts from another paper in the *Athenium*, Vol. 22, No. 1144, p. 991, London, Sept. 1849. He also gives brief records of Mallet's subsequent experiments in the nineteenth century, pointing out that he was then doing actually what the geophysicist in refraction work does to-day.

In 1917 Fessenden filed a patent application on methods and apparatus for locating ore bodies which covers both refraction and reflection seismic methods as used to determine geologic formations. Refraction and reflection methods are widely different. Instances of several successful surveys made by the reflection method in 1928 and 1929 are given. In 1929 the dip method, a gradient method of reflection shooting differing somewhat from the reflection method, was brought out by the Geophysical Research Corporation. It is mainly used for detailing salt domes on the Gulf Coast with some degree of success in discovering deep-seated structure.

In conclusion, the author maintains that since the discovery of the huge East Texas oil-field 5 years ago, actual discovery of oil in the U.S.A. has been unable to fulfil the consumption demands, and that, without the help of geophysics, the supply would have been still further short of requirements. The geophysicist is, and must be, the future mainstay in the search for oil. B. F. N. M.

550.83 : 553.982

347. On the Strategy and Tactics of Exploration for Petroleum. E. E. Rosaire. *J. Soc. Petr. Geophysicists*, 1935, **6**, 11.—This paper opens with the complaint that there is an unfortunate lack of open-mindedness among oil men who utilize geophysical methods, the adherents to any one particular method being unable to admit the claims of any of the other methods.

Three purposes of the paper are given :—

1. Successful strategy in the use and development of geophysical methods in exploring for petroleum.
2. The choice and sequence of methods to be used in an exploration campaign.
3. The relative importance of tactics and of strategy.

The proper use of various exploration methods is now the exception, not the rule. Strategy is the approach to the solution of a problem engendered by policy and tactics is the means of solution.

The author then reviews De Golyer's "Notes of the Early History of Applied Geophysics," and gives De Golyer's abandonment of the torsion balance for the refraction seismograph, and then instigation of the development of the reflection seismograph as an instance of really long-range strategy.

A table is given of recognized methods of exploration in order of approximate increased cost and of approximate resolving power: 1. Library methods (including other people's data used ethically or unethically). 2. Surface geological methods. 3. Aeroplane photography. 4. Core drilling. 5. Magnetometer. 6. Gravity meter. 7. Torsion balance. 8. Refraction seismograph. 9. Reflection seismograph. 10. Drill (including subsurface palæontology and stratigraphy and electrical logging). The author then lays down the following rules for discovery at a minimum cost :

1. Prospects should be first located by the suitable method of lowest operating cost,

then the value determined and areas selected by the successive use of the appropriate methods of higher cost.

2. Development operations in any one area should not be started until the prospect has been explored by the suitable methods of lower cost.

The exploration status of 13 different petroleum-producing provinces in the U.S.A. is then reviewed, and the effective sequence of one (the Gulf Coast) is given as : 1. Library methods. 2. Torsion balance. 3. Reflection seismograph. 4. The drill.

The author considers that mainly the petroleum-producing areas in the U.S.A. having possibilities for discovery are now in the position of being discovered either by the reflection seismograph or by the drill.

The problem to-day is to discover and estimate the value of structures at depths of 1 to 3 miles.

The future of the various geophysical methods is summed up as follows : The electrical method may some day actually discover petroleum "in situ" at present-day shallow depths in those areas as yet unexplored by any geophysical methods. Improvements of the torsion balance, the gravity meter, the magnetometer and the refraction seismograph are warranted, provided that marginal prospects can be disclosed by them. So long as prospects remain to be discovered by the reflection seismograph, its improvement can be studied and evolved.

The paper suggests that the prospects of discovery in the U.S.A. of new oil-fields at a depth of less than 1 mile are now very small, and reserves of oil for the future must be sought at depths of between 1 and 3 miles, and probably be delineated by the reflection seismic method or by improvements on that method. B. F. N. M.

550.83 : 553.982

348. Science and Technology will have Increased Application this Year. L. G. E. Bignell. *Oil & Gas J.*, 30.1.36, **34** (37), 78.—An increase over 1935 in geophysical exploration for new pools is indicated. Geophysical methods will be employed not only on dry land areas, but also over the shallow coastal waters along the Gulf Coast and in the Pacific Ocean. The Fitts field in Oklahoma and along the Gulf Coast of Texas and Louisiana have proved the great value of geophysics, and geologists have many new theories of oil accumulations which will be tested by geophysical methods followed by the drill. B. F. N. M.

550.83 : 553.982

349. Scientific Methods locate Structures in which to Drill for Oil. J. B. Umpleby. *Nat. Petr. News*, 5.2.36, **28** (6), 379.—Early, middle and present-day methods are described and contrasted. The seismograph, having the widest field in the search for oil in the U.S.A., is given a fuller description than the other methods.

The seismograph has produced wonderful results in many localities, but geological conditions limit its uses. Salt plugs within loosely consolidated beds afford perfect conditions for the method. In Oklahoma a succession of shale, limestone and sandstone in descending order and in close contiguity also gave very good results. Faults and buried erosion surfaces form disturbing factors. Thick beds of gypsum act as blankets obscuring seismograph readings for underlying formations. That all the generally recognized geophysical methods now in use are confined to the direct search for favourable structure or possible oil traps, and not for oil itself, must be emphasized. The proof that the wonderful East Texas Oil-field is controlled by the lensing out of the producing horizon eastward up the regionable dip with little or no folding or faulting, caused no small difficulty in working out geophysical and geological conclusions as to the real structure.

That there are more than 200 seismograph crews at present working in the U.S.A. shows that this method is the most extensively used. These crews cost about $2,000,000 monthly, and applying this figure to the daily oil production of the States, nearly 3 cents a barrel is chargeable to seismic exploration. The American Petroleum Institute estimates the cost of drilling dry holes in the U.S.A. to be $12,500,000 a month, and if the seismic cost is added, there is a monthly charge of 20–25% on gross production revenue, attributable to endeavours to find crude oil for future requirements. B. F. N. M.

550.834

350. Explosives and Electric Blasting Caps for Geophysical Prospecting. G. H. Loving and G. H. Smith. *J. Soc. Petr. Geophysicists*, 1935, **6**, 27.—This paper traces the evolution from the refraction seismograph method of shooting by stacking the explosive on the surface and placing the geophones on the arc of a circle several miles distant from the shooting point, through the use of the shallow holes to the reflection method of deepholes 3–5 ins. in diameter from 25 to 500 ft. deep with relatively small charges of explosive, and recording only the reflection waves near the shot point and at various selected points.

The reflection method needs an altogether different explosive from that of the refraction method. The most generally used explosive for the reflection method is the 60% ammonia gelatin. Description of its necessary consistency, its packing, behaviour at various temperatures and in water is given.

Electric blasting caps are described, and the necessity for a special design of cap for seismograph exploration is explained. An electric blasting cap must possess, in addition to proper uniformity of detonation, other essential qualities, viz. excellent water resistance and detonating power. B. F. N. M.

550.834

351. Note on the Theory of Seismic Prospecting. C. H. Dix. *J. Soc. Petr. Geophysicists*, 1935, **6**, 34.—This paper opens with an explanation of the *iso*time curves and of the critical point curves. Geometrical constructions of the work of establishing these curve points bring out descriptive features clearly.

The paper is illustrated by 5 geometric figures, which are explained by formulæ and equations. B. F. N. M.

550.834 : 553.982

352. Discovery by Reflection Seismograph of a Small Producing Structure in Okmugee County, Oklahoma. G. H. Westby. *J. Soc. Petr. Geophysicists*, 1935, **6**, 44.—The object of this paper is to describe the reflection seismic discovery of a small oil-field in this area. Areas of structural relief of 50 ft. or less of closure require a technique which will reduce the seismic error to its minimum, as great detail is necessary to map accurately sharply dipping small structures.

The author directed a second seismic survey by the reflection method, which confirmed and elucidated the previous seismic work. The Taneha sand of Pennsylvania age and the Wilcox sand were the two known oil horizons. The first well was completed in Taneha sand as a small oil and gas well. The second well was drilled for the Wilcox sand. The seismic work checked perfectly with the result of the second well, which is producing gas and oil from the Wilcox sand. A description of the equipment and methods used in this seismic is given and is illustrated by 7 figures.

The result of the well in the Wilcox sand made the geological deductions based on the seismic seem incorrect, and a detailed survey of the small area was carried out to increase the accuracy of the depth determinations. The method of detailed seismic survey is described, and the result showed that the original survey was very competent to a certain degree of accuracy, but was not spaced closely enough to secure adequate data on areas of small structure and steep dips.

The conclusion reached is that the seismic reflection method correctly applied is thoroughly satisfactory for these small structures, but must be absolutely detailed. The method used in the second survey indicates that each point shown on the map gives the accurate depth to an index formation within 10 ft. B. F. N. M.

550.837

353. Spontaneous Polarization. M. I. Kuznetzov. *Groz. Neft.*, 1934, **4** (11), 25–28.—In laboratory experiments carried out for the purpose of checking the spontaneous polarization (S.P.) method introduced by Schlumberger for prospecting for oil, the following results are reported: (1) The magnitude of S.P. is proportional to the exercised pressure. (2) The size of the area which serves for filtration does not affect the magnitude of S.P. (3) The S.P. changes in proportion to the resistance of the

electrolyte. (4) In a circulation of an impure electrolyte through a sand layer the S.P. decreases with the passage of the electrolyte. (5) In this case S.P. decreases in proportion with the decrease in the oil yield. (6) The lowering of S.P. and the yield of oil is caused by clogging up of the same. (7) In the clogging of the sand a layer a few mm. thick is formed (crust) which adsorbs the pressure and prevents the appearance of S.P. (8) The yield of the electrolyte is not proportional to the pressure. It is concluded that the S.P. method permits the determination of aqueous layers and the density of intermediate layers. It also permits the detection of non-permeable layers in petroleum layers. For. Petr. Techn.

550.834 : 608.1

354. Patents on Geophysics. W. T. Born. U.S.P. 2,003,780, 4.6.35. The method of seismic surveying which comprises detonating a charge of explosive near the earth's surface, recording only waves received at a single point near the shot point, and recording only waves after reflection from a subsurface formation; impressing received waves on a recorder rendered inoperative until after the direct waves have passed beyond the receiving point; receiving waves at a single point sufficiently near the shot point that the direct waves have passed completely beyond the point, before waves reflected from a subsurface formation reach said point and recording only reflection waves.

550.837 : 608.1

J. J. Jakosky. U.S.P. 2,015,401, 29.9.35. Method of field procedure for the study of subsurface structure by means of electrical potential and magnetic measurements made at the surface of the earth.

550.837 : 608.1

C. Schlumberger. French P. 615,219, 9.10.26. Method for determining oil deposits. This method, the object of the invention, consists of searching for oil by measuring the electric conductibility of the ground, and by deducing from the observations thus collected the points of maximum salinity; consequently the points where oil and gas should be found. The method is realized practically by making a series of systematic measurements of the electric conductivity of the ground in a series of chosen stations on the surface, then by comparing the results obtained to select the zones of maximum conductivity which will correspond with the oil deposits. B. F. N. M.

Drilling.

622.24

355. New Drilling Trends. B. Mills. *Oil Weekly*, 27.1.36, **80** (7), 23.—Refinement rather than radical change of drilling equipment or methods is reported for the year 1935. These refinements permit the easy attainment of the required depths.

The application of the direct-current, variable-voltage system of speed control to rotary drilling has proved successful from the standpoints of economy, efficiency and portability.

A portable alternating-current power plant with two engines, a generator and the necessary control apparatus, all mounted on a common base made its appearance during the year. The diesel engine has been popular in many districts where fuel, water and transportation are a problem and refinement in both design and price has added to its popularity.

Steam rotary drilling outfits are still popular in those districts where fuel and water are available in sufficient quantities.

Direct-drive rotary tables are being used with success in California and the use of automatic catheads has increased. L. V. W. C.

622.24

356. Research on Drilling, Grosneft 1934. V. S. Federov. *Groz. Neft.*, 1934, **4** (11), 40–43.—The report covers the following items: Cave-ins, performance of automatic drilling regulators, theory of the performance of the drill, investigation of the factors of the mechanical speed of drilling, performance of mud pumps, dynamics of the performance of drilling tubes, use of electrical energy in the operation of rotary drilling equipment and recording instruments. For. Petr. Tech.

622.242.2

357. Unusual Boiler-feed Hook-up. M. I. Halbouty. *Oil Weekly*, 3.2.36, **80** (8), 33.—A complete unified boiler-feed hook-up has been completed in the Gulf Coast area. This hook-up can be carried from one location to another without dismantling. The boiler-feed pumps, generators, water heater, water-heater manifolds, etc., are all bolted and connected to two large 6-in. drill-pipe skids. L. V. W. C.

622.242.2

358. Scientific Heat-Conservation Effects Major Economies in Steam Drilling. M. W. Phelps. *Oil & Gas J.*, 2.1.36, **34** (33), 26.—The conservation of heat either at the boilers or in connection with the prime movers using the steam has only recently been attempted. The major points at which there is an opportunity for appreciable heat conservation on the drilling rigs are: (1) feed-water heating, (2) boiler efficiency, (3) superheating, (4) slushpump prime mover, (5) rotary prime mover and (6) boiler and steam line insulation.

An open-type feed-water heater has been placed on the market. This operates on the same principle as the jet condenser for heating the feed water. The water is heated to within 15–25° F. of the temperature of the exhaust steam in the heater chamber.

Superheating the steam results in operating improvements on a drilling rig. Condensation is completely eliminated when superheat of 100° F. is used. Heavier demands can be made on the machinery when dry or slightly superheated steam is supplied.

Roughly 50% less boiler capacity is required when heat conservation is carried out, and it is estimated that one 125 H.P. 350 lb. working pressure boiler used in conjunction with heat-conserving equipment could readily drill a 6000-ft. well.

L. V. W. C.

622.24.051.5 : 621.791.352

359. Flexibility of Electric Hook-Up. W. C. Dreyer. *Oil & Gas J.*, 19.12.35, **34** (31), 62.—One of the large factors responsible for the increasing demand for electric transmission for rotary drilling equipment is the flexibility of such transmission. Another factor which plays a large part in the successful operation of such power is the economy of using any of the many types of internal-combustion engines as prime movers for drilling. L. V. W. C.

622.243.5

360. Electric Brazing of Bits with Pieces of Alloy Metals. V. Bogolyubskii. *Neft*, 1932, **3** (23), 23.—The preliminary operations are similar to gas brazing, except that the cutting edge of the bit is slightly thicker. The bit is placed in a box with sand. One pole is connected with the bench, to which is connected the metal electrode, whilst the other pole is connected directly to the graphite electrode. Graphite plates are placed on the cutting section of the bit so as to protrude 3–5 mm. beyond the cutting edge. Then an arc is formed between the metal and the carbon electrode so as to melt the metal and weld the alloy to the metal electrode. An arc is then established between the carbon electrode and the bit surface so as to melt some of the latter, while keeping the metal electrode hot. The end of the metal electrode is then placed in the melted spot of the bit, whereby the hard alloy is released from the electrode and brazed to the bit. For. Petr. Techn.

622.243.7

361. Controlled Directional Well Drilling and Surveying Practice. Part VI. J. D. Hughes. *Petr. Eng.*, Jan. 1936, **7** (4), 38.—Controlled directional drilling may be divided into three classes, straightening, side-tracking and objective drilling.

Straightening may be carried out by weighting the bottom joint, holding up on the weight and rotating rapidly, by employing special straight-hole bits, or by underreaming and using limber bottom joints with small-diameter bit to rat-hole on low side. Failing these the removable whipstock may be used with advantage.

In other straightening jobs "shouldering up" or "plugging back" may be employed.

In side-tracking plugs in rock-like formations the whipstock is used.

Objective drilling is drilling directionally to an objective established by any one of a number of necessities. Among these are maintaining the course of the hole so that it will bottom under the derrick, deflecting a hole across a fault, deflecting a hole to the under side of a salt dome, overhang, etc. L. V. W. C.

622.245.1

362. First Two-Mile String of 6⅝-inch Casing. W. A. Sawdon. *Petr. Eng.*, Jan. 1936, **7** (4), 84.—The world's longest string of 6⅝-in. casing has recently been run by the Union Oil Company in the Kettleman Hills area. This string was set and cemented at 10,815 ft. It was floated in, and was cemented far enough up the string to eliminate any danger of collapse. L. V. W. C.

622.245.1

363. Record String of Casing Landed in Deep Test. L. P. Stockman. *Oil & Gas J.*, 9.1.36, **34** (34), 30.—What is believed to be the world's record of casing landed has been carried out by the Union Oil Co. A length of 10,813 ft. of 6⅝-in. pipe has recently been landed and cemented with 70 sacks of cement. It was floated in with two cement float collars and one cement float shoe in 15 hours. L. V. W. C.

622.245.17

364. Design of Casing Elevators should be Governed by Imposed Working Load. M. L. Langleben. *Oil & Gas J.*, 21.1.36, **34** (33), 30.—This article discusses the design of drill-pipe and casing elevators according to the theoretical stresses placed on a cross section of the elevator body. Certain objections to present design methods are set forth. L. V. W. C.

622.245.42

365. Influence of Prolonged Exposure to Elevated Temperatures on the Mechanical Strength of Portland Cement. A. A. Strigotzkii and E. K. Machinskii. *Groz. Neft.*, 1934, **4** (9), 48–50.—According to the experiments described, a continuous increase in the strength of cement is observed within the temperature range of 20–100° C. within the first two days, whilst among samples left to harden for 28 days the strongest were those which were exposed to a temperature of 20° C. A cement mortar prepared at 20° C. loses its strength when hardening in a bore hole at a temperature of 120° C., although it retains a strength equal to that of sandstone. For. Petr. Tech.

622.245.42

366. Causes for Unsatisfactory Cementing Operations. Machinskii and Lebendenko. *Groz. Neft.*, 1935, **5** (1), 20–26.—The following explanation is given for unsatisfactory cementing of bore holes in the Grozny oil-fields.

(1) The temperature at the shoe of the bore holes and that of the water used for preparing the mortar was too high.

(2) Poor contraction of the casing tubes.

(3) Pressure of the subterranean water located above the shoe.

(4) Admixture of the mortar with excessive amounts of mud.

Various recommendations are made. For. Petr. Techn.

622.245.49

367. Injecting Process for Sealing Water Sands. K. C. Sclater. *Petr. Eng.*, Jan. 1936, **7** (4), 28.—The general method of shutting off bottom water in an oil or gas well is to place a cement plug in the bottom of the hole. Certain conditions in the well may result in failure of the plug. Such a failure has led to the development of a method of injecting a thin slurry of cement into water-bearing sands to shut off water.

The method consists of loading the well with heavy mud fluid, then displacing some of the mud in the bottom of the hole with clear water. With the casing-head closed

and a column opened in the annular space between the tubing string and the casing, water is then pumped under pressure into the water-bearing sand. The water is followed up by a thin slurry of cement, which also is pumped under pressure into the water sand. The cement is then followed up with heavy mud to clear the tubing of cement and the cement is allowed to set.

The theory underlying the process is that an oil sand resists the injection of water to a much greater degree than a water sand. L. V. W. C.

622.24.053 : 608.3

388. Patents on Drilling Plant. R. P. Fisher. U.S.P. 2,025,944, 31.12.35. Rotary drilling jars.

622.243.1 : 608.3

R. C. Baker. U.S.P. 2,026,295, 31.12.35. A fishing tool comprising a barrel, for lowering over the fish, in which expansible means are provided for engaging and directing a fish into the barrel.

622.243.1 : 608.3

W. H. Dumble. U.S.P. 2,026,778, 7.1.36. A grab-type fishing tool with the grabs operated by a gear reduction unit. The grabs are opened and closed by a rotation of the gear unit.

622.245.44 : 608.3

C. P. Gillespie. U.S.P. 2,026,883, 7.1.36. A well packer operated by forcing a series of wedge blocks outward by the downward movement of a mandrel.

622.24.053 : 608.3

E. Burns and H. P. Wickersham. U.S.P. 2,026,931, 7.1.36. A releasable jarring tool for rotary drilling.

622.243.5 : 608.3

A. E. Johnson. U.S.P. 2,027,734, 14.1.36. A rotary drilling outfit driven by a rotary table, but with the drill-pipe supported by a flange on the upper end of the pipe resting in a shoulder on the elevator.

622.245.2 : 608.3

J. C. Smith and J. S. Taylor. U.S.P. 2,028,418, 21.1.36. A well clean-out tool comprising a dirt-receiving chamber adapted to receive and trap fluid under pressure.

622.243.5 : 608.3

J. C. Wright. U.S.P. 2,028,579, 21.1.36. A rotary core drill.

622.243.5 : 608.3

J. W. MacClatchie. U.S.P. 2,028,910, 28.1.36. A rotary reamer having cutting teeth spaced around the entire circumference, the leading edge of each tooth extending below the trailing edge of the next preceding tooth and the lower faces of the teeth slanting downwards circumferentially and toward the trailing ends of the teeth.

622.245.17 : 608.3

E. Burns and H. P. Wickersham. U.S.P. 2,028,966, 28.1.36. A releasable overshot.

622.245.1 : 608.3

S. E. Manning. U.S.P. 2,029,380, 4.2.36. A method of setting screen pipe in wells comprising pumping a number of charges of cement down through the casing, discharging one of the charges at the lower end of the screen and then discharging the next at the upper end of the screen.

622.245.14 : 608.3

W. I. Wells. U.S.P. 2,029,454, 4.2.36. An air-operated gun type perforator capable of submergence in an incompressible medium. This medium is permitted to enter the tool and compress the air.

621.65 : 608.3

C. E. Fox. U.S.P. 2,029,473, 4.2.36. A combination reciprocating and rotary pump. Upon the operation of the reciprocating pump the rotary pump is actuated to forcibly inject fluid into the reciprocating pump.

622.245.14 : 608.3

M. W. Haines. U.S.P. 2,029,478, 4.2.36. A submergible gun perforator containing a medium under pressure sufficient to flow from the holding chamber against the pressure of the liquid in which the gun is submerged.

622.245.14 : 608.3

W. G. Lane. U.S.P. 2,029,490, 4.2.36. Method and means for controlling deep-well gunfire for perforating casing.

622.245.14 : 608.3

W. G. Lane. U.S.P. 2,029,491, 4.2.36. A gun-type formation tester comprising a sampler and means for unsealing this sampler and forming communication from the formation to the sampler.

622.24.053 : 608.3

I. J. McCullough. U.S.P. 2,029,579, 4.2.36. Rotary jarring tool.

622.243.18 : 608.3

J. R. McCurry. U.S.P. 2,030,015, 4.2.36. Apparatus for forming and surveying earth cores.

622.245.44 : 608.3

J. A. Crumley. U.S.P. 2,030,164, 11.2.36. A fluid release packer head having tubing seated on the packer with a passage extending through a side wall and a rotatable tube arranged in the tubing so that a hole cut in it registers with the passage when the tube is rotated to a certain position. L. V. W. C.

Production.

622.276

369. 1935 Producing Trends. W. L. Baker. *Oil Weekly*, 27.1.36, **80** (7), 35.—Producing trends for the year 1935 may be divided into three main divisions: (1) operation of stripper well properties, (2) flush producing methods and (3) semi-flush well practices.

In the first division must be mentioned water-flooding methods in the Mid-Continent area. Hitherto all water flooding, with the exception of a few experimental projects, has been confined to the eastern fields.

Repressuring of sands of semi-depleted areas has increased in many districts, but practices used are not different from previous ones. The use of one engine for compressing the gas and for generating electric current for pumping wells is of interest.

Slow speed pumping has received wider usage and reconditioning work has been abundant. Mining for oil has also been carried out in the Texas field.

The flush fields received attention so far as bottom-hole data are concerned, and acid treatment of wells increased during the year. L. V. W. C.

622.276

370. Proper Choking is Vital. B. Mills. *Oil Weekly*, 3.2.36, **80** (8), 28.—The determination of the most effective size for chokes or flow beans on flowing oil or gas wells is important in the control of factors that produce the best operating results. A quick change in the size of a choke on a large-flowing well may not produce immediate results, but the same change on a weak-flowing well may cause violent fluctuations that lead to serious trouble.

By the use of correct choke size in wells affected by water encroachment, the wells may be restored to a flowing status. Incorrect use of chokes on large-flowing wells in new high-pressure fields may give good results initially, but trouble may ensue in the future.

Every well is a different problem and must be considered as such. Conditions vary

throughout the life of a flowing well and the efficient back pressure can be found only by experimenting. L. V. W. C.

622.276

371. **Rational System of Working the Grozny Petroleum Deposits.** I. P. Karasev. *Groz. Neft.*, 1934, **4** (9), 9–12.—After giving a detailed analysis of the conditions of the Grozny oil-fields, it is concluded that: (1) A definite relationship between the original yields, the area and the duration of production is characteristic for this area; (2) A prolonged drilling period lowers the final yield of oil, leaving large amounts of oil in the ground; (3) With an increase of the drainage area, the crossings of the "distance" and "time" curves have a tendency to increase; (4) The magnitude of the area of the crossing curves of "distance" and "time" depends on the average grain-size of the particular layer, i.e. the crossing will take place at the lowest area of the layers having the lowest average grain-size. Consequently the time factor of bore-holes having a draining area exceeding that of the crossing curves "distance-time" will not be a factor affecting the initial yield; (5) The time required for the lowering of the production is prolonged with the wider spacing of bore-holes; (6) The highest yield from the layer is reached when working the entire field; (7) The yield is lowered when working according to (6) on increasing the spacing between the oil wells; (8) A "gradual" system of working the layer yields intermediate results which are between "converging" and "entire developing" systems; (9) The "converging" system has the lowest utilization factor of the layer; (10) The utilization factor decreases when spreading the drilling over a number of years; (11) The yield of the layers having a hydraulic performance is the same with all working methods.

For. Petr. Techn.

622.245.593

372. **Three Years' Experience in Acidizing Four Hundred Wells Shows it Pays.** W. B. Lerch. *Oil & Gas J.*, 2.1.36, **34** (33), 32.—The primary purpose of acid treatment is to increase the rate of production of oil and gas and to increase the total amount to be recovered. The use of acid is justified if the rate of production only is increased.

From the experience obtained from the acid treatment of hundreds of wells, it has been learned that a succession of re-treatments followed in the proper order have undoubtedly had the effect of further increasing ultimate recovery of the wells.

Acid treatment of wells involves many hazards, requires the use of proper materials and equipment and the education of those in charge of the work. A complete knowledge of the producing formations, pressures applied and a careful study of the physical characteristics of the wells to be treated are of the greatest importance.

The acid treatment of wells has become a recognized part of the operations of the industry and it is certainly of the greatest economic importance. L. V. W. C.

622.245.593

373. **Great Strides Made in Acid-Treating Wells.** J. C. Albright. *Petr. Eng.*, Jan. 1936, **7** (4), 47.—Acid treatment has progressed to such an extent that many wells are given a treatment immediately following completion to open up the tighter zones, so as to enable the entire formation to be drained uniformly. When wells are treated in the early stages the formation pressures remain practically unaltered, and an increase in bottom-hole pressure after the use of acid indicates that the oil is coming from the formation with less friction, and consequently less gas energy.

Blankets to confine the acid to the desired stratum have been developed, and would appear to be the forerunners of directional treating of wells.

The selection of a proper blend of acid is of great importance, since some formations react upon the application of dilute acid, whilst others need a catalyst to speed up the reaction. The strength of acid to be used has been investigated, and it has been found that if a highly concentrated acid is injected into a well with little or no water added, it either works too rapidly so that it does not penetrate to any great distance, or that the water formed by the reaction in the pores is insufficient to dilute the calcium chloride salt to the extent that it can be brought to the surface.

L. V. W. C.

622.248

374. Cleaning out Paraffin. J. C. Albright. *Oil Weekly*, 3.2.36, **80** (8), 24.—The accumulation of paraffin in the artificially produced wells at Oklahoma City is causing serious problems. It is believed that the change in velocity or temperature or both at the point where the method of production changes from the centrifugal pump to gas-lift in wells where the dual lift is used cause this deposition. Where the wells are produced by straight beam pumping the trouble is apparent inside the tubing string.

Solvents are being used in a large number of wells to prevent accumulation of paraffin and to remove it when it does begin to form. Two kinds of solvents are used. One is a natural gasoline of a grade corresponding to a 26/70 product, and the other is a heavier hydrocarbon fraction made from the distillation of crude oil in refineries. This has a gravity of about 40 degrees A.P.I.

These solvents are injected into the well and " rocked " a number of times to remove the paraffin. L. V. W. C.

622.276.4

375. Gas-Lift Plant Costs. S. F. Shaw. *Oil Weekly*, 6.1.36, **80** (4), 19.—The largest single item of expense in gas-lift operations is compressing the gas to be employed. Where high-pressure gas is available from wells, the lifting expense is low, even if waste of gas is allowed. On the other hand, if operating costs of the plant are high, even an efficient application of the compressed gas might make the costs prohibitive.

The compressor plant must be constructed, bearing in mind the factors of low operating cost and flexibility in operation. L. V. W. C.

622.276.45

376. Unusual Gas-Lift Plant. J. C. Albright. *Oil Weekly*, 20.1.36, **80** (6), 33.—Owing to the urgent necessity for gas-lift stations in the Oklahoma City field, it has been found impossible to build cement foundations, and in one case the actual foundations have been fabricated from heavy boiler-plating. Thus each machine has a separate steel skid base with a gravel flooring. L. V. W. C.

622.276.45

377. Double and Single Lifts. I. M. Asadov and S. M. Bortz. *Azerb. Neft. Khoz.*, 1934, **11–12**, 45–50.—According to experiments which are described, the following conclusions are reached: (1) Double lifts are always more efficient than single lifts, this being due to the effect of pulsation of the single lift; (2) The arrangement of a 1-mm. opening above the liquid level causes increased losses in the process of compressing, as well as during the normal operation of the oil well; (3) The 1-mm. opening should be arranged in such a manner as to permit the initiation of the aeration 5–6 atm. below the maximum compression capacity of the compressor; (4) In oil wells which do not produce sand and which, because of a high initial pressure, work with a shallow immersion and low working pressure, it is of advantage to have a deeper immersion with the application of a 1-mm. opening. An increase of the immersion not only compensates losses through the 1-mm. opening, but also increases the yield of the compensated amount; (5) In wells with defective walls of the casing, where the Stykalo-Groshstein method cannot be applied for lowering of the initial pressure, a coupling with 1-mm. openings should be placed on the lifting tubes calculated on a pressure 5–6 atm. the maximum capacity of the compressor; (6) A 3-mm. inlet for the working medium in the lift lowers the efficiency of the operation. (7) Two 7–8-mm. openings which, under normal conditions, permit building up a pressure of 2 atm., are more advantageous than two 3-mm. openings with a resistance of 8 atm.; (8) A standard opening cannot be recommended in all cases, because the passage of the air through the openings depends on its velocity. The diameter of the opening of the coupling of the working tube must be determined on the basis of air consumption required for the given well and the desired pressure; (9) The application of a coupling (collar) and a tail end can be recommended only for oil wells producing sand and having high pulsation. For. Petr. Techn.

622.276.95

378. New Type Pneumatic Pump for Oil Wells. R. L. Chenault. *Oil & Gas J.*, 9.1.36, **34** (34), 34.—A pneumatic pump of new and improved design has been developed by the Gulf Research and Development Corpn. A limited number of tests have shown that it is economical and dependable. This pump is an improved arrangement for intermittent gas lift which may be used in several different ways depending on the oil production desired, the gas pressure available, the formation pressure and the formation gas–oil ratio in the field.

The capacity of this pump is higher, and less gas is required for operation. The valves are positively controlled from the surface and are not likely to become sanded, hence the operation is more reliable. The capacity can be regulated to any value below maximum without the loss of efficiency, and it is not necessary to run intermittently for small production. There is very little wear on the moving parts of the pump, and gas from any source can operate it. L. V. W. C.

622.276.95

379. Study of Recovery by Air or Gas Drive Planned at Pennsylvania State. R. C. Conine. *Oil & Gas J.*, 26.12.36, **34** (32), 60.—The factors involved in the recovery of petroleum from reservoir rock by air in gas drive are to be investigated by the Pennsylvania Grade Crude Oil Association.

The operating side only is to be investigated, and the plan to be carried out is outlined. L. V. W. C.

622.276.95

380. Repressuring Sands with Gas in Pennsylvania. R. C. Conine. *Oil & Gas J.*, 2.1.36, **34** (33), 38.—Repressuring with gas is becoming a more popular method of producing oil in the older eastern fields of Pennsylvania. On the Warren lease a new development programme has been commenced. Ten wells have been hooked up with an 18-ft. band wheel power. The gas produced on the property is introduced to the Glade Sand through a pressure well affecting a single five spot. Additional pressure inlets are being drilled. The spacing for oil wells is 150 ft., with the distance from pressure inlet to oil producer about 114 ft. It is expected that some air will be required to increase the quantity of gas injected. L. V. W. C.

622.276.95

381. Storage of Residue Gas. L. E. Bredberg. *Oil & Gas J.*, 26.12.35, **34** (32), 56.—Underground storage of excess gas is receiving considerable attention in the Panhandle. The Lone Star Gas Co. has undertaken an experiment in an old depleted field. On June 1st last it started to return 5,000,000 cu. ft. of gas per day to the intake wells where the pressure had fallen to 140 lb. from the original pressure of 1300 lb. After six months' injection the pressure has risen to 375 lb.

The gas being returned to the sand is stripped of its gasoline and is injected during the summer months, when the demand for domestic gas is low, storing it until the high demand during the winter. L. V. W. C.

622.323

382. Subterranean Gasification of Oil Layers under Natural Conditions. A. B. Sheiman, K. K. Dubrovai, N. A. Sorokin, M. M. Charigin, S. L. Zaks and K. E. Zinchenko. *Neft. Khoz.*, 1935, **28** (4), 48–61.—The experiments were carried out in an abandoned part of the Shirvan fields, which were not flooded and were exhausted of oil. The ignition of the oil still left in the sands was effected either by means of a special furnace constructed near the bore-hole or in the bore-hole itself by lowering burning charcoal (which was ignited later) and pumping air into the hole. Two bore-holes were drilled at various distances from the ignition bore-hole to study the range affected by the heat. It was found that the oil present up to 200 metres from the ignition hole was still recoverable. The heated sands released the entire oil still left in the ground. A number of modifications of the procedure is described and a detailed description of the experiments presented. For. Petr. Techn.

628.54 : 614.777

383. Oil-field Brine Disposal. C. J. Wilhelm and L. Schmidt. *Oil Weekly*, 20.1.36, **80** (6), 27.—A careful study of the problem of brine disposal indicates that returning the brines to the formations probably offers the most satisfactory solution.

Future contamination when wells are abandoned will be prevented by cementing the surface casing, and wells which are producing from the Viola limestone, that show indications of producing water from upper horizons, should be repaired.

The dumping of the brine in the surface streams offers possibilities of the disposal of part if the streams are included in flood control projects. L. V. W. C.

621.65 : 608.3

384. Patents on Production Apparatus. W. C. Perry. U.S.P. 2,026,058, 31.12.35. A plunger for oil well pumps, comprising a single tubular member which makes contact at its lower circumferential edge throughout its stroke. A recess is cut in the plunger to enable any gas below the pump plunger a free path to a valve placed in the recess.

622.276.4 : 608.3

H. F. Beardmore. U.S.P. 2,029,457, 4.2.36. A stage lift method of producing wells.

622.245.49 : 608.3

E. E. Ayres. U.S.P. 2,029,649, 4.2.36. A method of selectively shutting off water flow in an oil well penetrating oil and water formations by forcing carbon dioxide under pressure into the well and the water formation in the presence of calcareous material. The carbon dioxide dissolves the calcareous material, the pressure is released and insoluble calcareous material is deposited, thus plugging the water formations.

622.276.4 : 608.3

B. H. Scott. U.S.P. 2,030,159, 11.2.36. Automatic control system for atomizing and lifting oil with gas.

622.276.4 : 608.3

H. W. Fletcher and R. Neuhaus. U.S.P. 2,030,436, 11.2.36. A plunger lift device including an eduction tube with openings at its lower end and a plunger movable from end to end of the tubing. At a certain level an inlet is arranged and a valve in the inlet to be operated by upward movement of the plunger and closed on the downward movement. L. V. W. C.

Storage.

621.178.642.34

385. Explosion of a Storage Tank through Self-Ignition of Sulphur Compounds. V. Gluizdenek. *Neft*, 1931, **2** (23), 19–20.—An explosion of kerosine distillate, which occurred in the Vannovskii refinery located on the Sredne-Aziatskaya RR., was caused by the high sulphur content (up to 2·2%) of the crude. Sulphur deposits and partial combination of the sulphur with the iron of the container were the probable causes of the explosion. For. Petr. Techn.

621.642.34

386. Steel Recovered from Idle Storage is Made into Lease Tankages. H. K. Ihrig. *Oil & Gas J.*, 9.1.36, **34** (34), 24.—A large number of 55,000-barrel riveted steel storage tanks in the old Burbank pool have become idle, and the Phillips Petroleum Co. has found a use for them by utilizing them in the manufacture of welded lease tanks. Tanks of sizes most used in producing fields are being fabricated from the plates of the old tanks, and considerable saving has been effected. L. V. W. C.

Chemistry of Petroleum.

543 : 621.892.2

387. Chemical Constitution of Lubricating Oil. B. J. Mair, S. T. Schicktanz and F. W. Rose, Jr. *Bur. Stand. J. Res.*, 1935, **15**, 557–573.—Researches on the chemical

constitution of the lubricating fraction of petroleum have been going on for more than 30 years.

Available information indicates that the average molecular formulas of lubricating-oil fractions range from C_nH_{2n} to C_nH_{2n-30}.

This paper gives descriptions of the apparatus and methods used and the results of the preliminary separation of a Mid-Continent petroleum into wax, extract and water-white fractions, with results of the first four stages of the distillation of the last.

The crude lubricating-oil fraction was fractionally distilled *in vacuo* before reaching the Bureau, and sixteen fractions representing 10% of the crude were used for this work.

The oil was first extracted with liquid SO_2 to remove asphaltic and resinous material, and then freed from wax by crystallization from ethylene chloride.

The raffinate from the SO_2 extraction contained S compounds, and was colour unstable when exposed to light and air. It was filtered through columns of silica gel, and a water-white filtrate, colour stable and containing less than 0·01% S was obtained. Most of the water-white oil had a viscosity–temperature relationship similar to that of a refined Pennsylvanian oil. The viscosity indices for the various fractions were :—

Original oil 75–90, wax 125–150, extract — 150 to — 300, water-white oil 100–120.

The water-white fractions have been vacuum distilled using (*a*) short fractionating columns for the more volatile portions, (*b*) molecular stills for the less volatile portions.

The results of the first four stages of distillation are given. D. L. S.

545.727.1

388. Thermal Cleavage of the Higher Paraffin Hydrocarbons by the Glowing Wire. F. Fischer, K. Peters and K. Winzer. *Brenn.-Chem.*, 1935, **16**, 421–429.—Experiments are described in which a Kogasin II, sp. gr. 0·787, 57·6% boiling between 200° and 300° C. or fractions thereof, was subjected to the cracking action of an immersed wire, heated to glowing by the passage of an electric current. Additional heat was supplied from an external element. The temperature of the glowing wire was measured by means of a 0·05-mm. platinum-rhodium element attached to the middle of the glow spiral. The condensing and absorption arrangements served to strip the gaseous reaction product of liquid, the remaining gas being collected and analysed.

Experiments using a platinum spiral at increasing temperatures yielded gaseous and liquid products in a constant proportion by weight of 4/1, the cracked gas containing about 70% of unsaturates by volume. The hydrogen content rose fom 5·3 to 12·5% by volume at amperages varying from 22 to 38, which effect was counterbalanced by changes in the volume per cent. of saturated hydrocarbons.

The gradual formation of a skin of graphite on the surface of the heating spiral necessitated the use of increasing power for the maintenance of wire temperature. Trials with graphite-free heating spirals showed that at the higher temperatures the proportion of gaseous to liquid products increased to 9/1, but that the composition of the reaction products was otherwise similar. The use of low wire temperatures led to the conclusion that slow-cracking results in a closer approximation to the primary reaction, and that the production of hydrogen and the increase of gaseous products with increasing temperature are consequential to the further decomposition of the primary decomposition products. Glowing wire cracking in a 350-c.c. autoclave at pressures up to 10 atm. yielded an increased production of liquid of a less unsaturated character, the iodine number of the 100° fractions from 0° to 300° C. being 243, 138 and 23, respectively.

An immersed electric arc at pressures of 1 and 0·1 atm. yielded gas/liquid ratios of 8/1 and 4/1, respectively, whilst at the lower pressure the gas contained 56% of acetylene.

With glowing wires situated in the vapour space changes in wire material were associated with variations in the reaction products. Platinum, copper and German-silver wires yielded reaction products of similar proportion and composition to those identified with the use of platinum immersed in the liquid phase, except that in the case of copper and German-silver the hydrogen content of the gas was low. Chromium, nickel and Konstantan yielded a high gas/liquid ratio, whilst wolfram, chromium

and nickel were productive of a relatively high proportion of hydrogen and a lower proportion of unsaturated hydrocarbons.

Variation of the type of paraffin fraction subjected to liquid phase treatment by the use of a Kogasin fraction b. p. 210–225° and of a solid paraffin m. p. 65° C., gave results comparable to previous experience.

Although the preceding experiments resulted in the separation of carbonaceous matter in variable degree, a benzine fraction b. p. 100–170° C. remained clear after long treatment. B. C. A.

547.21 : 538.7

389. Phase Equilibria in Hydrocarbon Systems. X. Thermodynamic Behaviour of Liquid Mixtures of *n*-Butane and Crystal Oil. B. H. Sage and W. N. Lacey. *Ind. Eng. Chem.*, 1936, **28**, 106.—The P.V.T. relationships of mixtures containing 0, 20, 40, 60 and 80 mass % of butane in crystal oil (highly refined paraffin oil) were measured at temperatures between 70° F. and 220° F., and pressures between the bubble point and 3000 lb. per sq. in. The experimental results were used to provide a table showing specific volume, heat content and entropy of the liquid mixtures, and to construct a series of graphs which show the variations of specific volume, compressibility, thermal expansion, specific heat, heat content, entropy, partial specific heat and partial specific volume (*i.e.* specific heat and specific volume for each component) over this range of conditions and compositions. P. D.

547.222.211

390. Chlorination of Methane. I. Carbon Tetrachloride. A. I. Kheprianov and T. S. Kusner. *J. Applied Chem. U.S.S.R.*, 1935, **8**, 673–684.—Carbon tetrachloride up to 90% of the theoretical value was obtained when passing a mixture of methane, hydrogen chloride and chlorine over an activated carbon catalyst at a reaction temperature of 525–530° C. The ratio of Cl_2 : HCl was 1 : 2, 160 litres chlorine being handled hourly by 100 gms. activated carbon at an approx. ratio, depending on the purity of $CH_4 : Cl_2 : HCl = 16 : 64 : 80$–$100$ litres. A detailed description of the experiments is presented. For. Petr. Techn.

547.531 : 542.951

391. Phosphoric Acid as the Catalyst for Alkylation of Aromatic Hydrocarbons. V. N. Ipatieff, H. Pines and V. I. Komarewsky. *Ind. Eng. Chem.*, 1936, **28**, 222.—In an apparatus consisting of an electrically heated rotating autoclave, provided with a glass liner to prevent corrosion, a gauge, a thermocouple well, and a valve, the authors have alkylated aromatic hydrocarbons using 85–89% orthophosphoric acid as a catalyst.

The alkylation of benzene, naphthalene and tetrahydronaphthalene with ethylene at 300° C. was studied and among the reaction products the following were identified: mono-, *m*-di-, *sym*-tri-, and tetra-ethylbenzene; diethylnaphthalene; mono- and di-ethyltetrahydronaphthalene. The various fractions from the alkylation of benzene were submitted to a destructive hydrogenation, the resulting products being ethane and benzene, indicating that the ethyl groups were attached to the aromatic nucleus.

Experiments were also carried out in the alkylation of naphthalene and fluorene with propene at 200° C. under pressure. Monopropylnaphthalene and monopropylfluorene were identified among the reaction products. Further, the propene underwent both polymerization and alkylation. H. E. T.

547.672.1 : 542.925.7

392. Destructive Hydrogenation of Anthracene. V. N. Khadzhinov. *For. Petr. Techn.*, 1936, **4**, 37.—Destructive hydrogenation of crude anthracene in an autoclave in the presence of MoS_2 at 480–500° C. yielded 32% of aromatics boiling below 180° C., and which was raised to 55% by recycling the products of higher boiling range. The catalyst remained active for 32 hours. Benzene, alkylbenzenes, naphthalene, alkylnaphthalenes and naphthenes were identified among the hydrogenation products. G. R. N.

665.51 : 536.7

393. **Phase Equilibria in Hydrocarbon Systems. XI. Thermodynamic Properties of Mixtures of a Crude Oil and a Natural Gas.** B. H. Sage and W. N. Lacey. *Ind. Eng. Chem.*, 1936, **28**, 249.—Specific volumes and specific heats were experimentally determined for several mixtures of a crude oil and a natural gas from Dominquez field, California. From these data the values of the heat content and entropy were calculated, and the data and derived data are presented graphically in a variety of forms. P. D.

615.778.75 : 542.944.03 + 547.22

394. **Action of Chlorine and Bromine on Medicinal Liquid Paraffin.** F. André and A. Maurel. *Ann. des Comb. Liq.*, 1935, **10**, 807–817.—By the chlorination of a liquid paraffin made by drastically refining a Russian engine oil, a product is obtained containing practically the theoretical amount of chlorine necessary to form a monochlor-substitution derivative. The product is heavier and more viscous than the original oil. It has a yellowish-green colour, but is odourless and tasteless. Bromination proved more difficult, at best only two-thirds of the theoretical amount of bromine to form a monobrom-substitution derivative being introduced. Attempts to accelerate the substitution with various metals were unsuccessful. The product was a brown viscous liquid, which, after standing in a stoppered flask, deposited a powder which re-dissolved on shaking at 30–35° C. This powder contained 33·5% of bromine, corresponding to a replacement of two hydrogen atoms in a substance of a mean molecular weight of 380. It is considered that there are some compounds in such a liquid paraffin which are more easily brominated. This claim is supported by the difference in bromine content of an acetone extract. The subject of bromination is to be further dealt with in a later publication. Particulars of the change in properties, together with experimental details of operation and analysis, are given. J. L. T.

Analysis and Testing.

532.13 : 665.3

395. **Viscosity of Vegetable Oils.** M. Tobia. *Olii e Min.*, 1935, **15**, 172–176.—After a brief survey of viscometers and viscometry, an apparatus is described and illustrated specially designed for measuring the "viscosity" of vegetable oils. It consists of two tubes fitting one inside the other. The outer acts as the temperature-controlling bath, and the inner contains the oil. The latter is forced up into a pipette-type bulb held in position inside the inner tube by the cork of the latter. The time of flow between marks above and below the bulb is noted. Times of flow have been determined at 10° C. intervals between 30° C. and 100° C. for 12 vegetable oils and time/temperature curves have been constructed. Results are also recorded on oils after heat treatment and after treatment with hydrogen, sulphuric acid and sulphur dioxide. C. C.

543 : 662.753.1

396. **Gravimetric Hydrocarbon Analysis of Gasoline.** Y. Polyakin. *Neft. Khoz.*, 1935, **28** (8), 74.—The apparatus consists of a series of gas wash-bottles. The system is first freed of oxygen by passing nitrogen, then a weighed amount of gasoline (0·1–0·5 gms.) is placed in a U tube after the nitrogen holder, and is evaporated by passing the nitrogen stream. The gasoline vapours pass through mercury acetate solution to absorb the unsaturates, then through absorbers containing solid caustic, P_2O_5 and H_2SO_4 activated with $AgNO_3$, which sulphonates the aromatics without attacking the naphthenes and paraffins. The vapours are then passed through an electric oven at 300° C. over platinized asbestos to convert hexanaphthenes into aromatics, whilst pentanaphthenes and paraffins remain unchanged. The aromatics so formed are absorbed with H_2SO_4, whilst the pentanaphthenes and paraffins are adsorbed with activated carbon. The hydrogen produced in the dehydrogenation is burned at 300° C. in a tube containing copper oxide, and the water formed is absorbed by P_2O_5.
For. Petr. Techn.

665.5 : 545.37

397. Acidity of Petroleum Oils. M. T. Pavlovskii. *Neft. Khoz.*, 1935, **28** (3), 75–77.—The Bukharov–Evstigeev electrometric method of acidity determination is carried out as follows. Two platinum–hydrogen electrodes are placed into products of different acidities, thus causing a flow current when connecting these electrodes because of the potential difference. One of the products, in this case, may be free of acid, and it may be only a blank. In the other, when titrating with alkali, the concentration of the hydrogen ions is lowered, and on complete neutralization the potential difference will be zero. The amount of alkali added for neutralization gives a measure of the acid present in the petroleum product. The apparatus is illustrated.
For. Petr. Techn.

545.81 : 665.521.8

398. Colour Testing of Bitumen. D. M. Wilson. *J.S.C.I.*, 1935, **54**, 1040–1042.—This paper deals with further work in connection with colorimetric methods of identification of bitumens. Owing to difficulties experienced by some operators with the Lovibond Tintometer, use has been made of a photocell, the bitumen solution being interposed between the latter and a standard light, sources and changes in output of the cell being measured in a microammeter. Typical results obtained on various bitumens are given, and precautions necessary in preparing the solutions are described. A. O.

621.317.755

399. Auxiliary Equipment for Cathode-Ray Tubes. R. R. Batcher. *Instruments*, 1936, **9**, 6.—This is the seventh article of a series dealing with the cathode-ray oscillograph, and it describes circuits for power supply and for obtaining operating potentials. Special characteristics which are needed in the various components are briefly discussed.
Methods of mounting the tube, and a description of the General Radio Co.'s complete cathode-ray unit, together with a circuit diagram, are given. P. D.

621.892.2 : 620.1

400. Behaviour of Oil Films at High Temperature. J. E. Southcombe. *Petr. Times*, 28.12.35, **34**, 705.—A modified apparatus for the determination of kinetic coefficients of friction is described. The friction surfaces consist of a ring $1\frac{1}{4}$ in. diameter, and $\frac{3}{16}$ in. wide, and a cylindrical block on which three ridges are machined. These ridges are ground at the apex to a flat a few thousandths of an inch wide. The first ring is rotated. A loading weight, carrying a circular graduated torsion head, is hung on the top test-piece. Suspended from the torsion head by three threads is a metal ring arranged for free movement in a vertical direction only. The frictional torque exerted on the top test-block by rotating the bottom one is thus balanced by the torque due to the suspended ring. The angular displacement θ of the graduated head is read when the system is in equilibrium. The torque T is given by $T = \frac{wr^2 \sin\theta}{\sqrt{l^2 - 2r^2(1-\cos\theta)}}$ where w = weight of suspended ring, l = free length of threads, 1 = radius of pitch circle of threads. In the present investigation the test-pieces were of polished cast iron, the load 180 lb./sq. in. and the speed of rotation 8 in. per min. Tests were carried out with thin films in free contact with air and with the bearings immersed in an oil-bath. Since the object of the investigation was the study of boundary lubrication in I.C. engines, tests were carried out over the temperature range 40–200° C. The results obtained on four types of oil are discussed. These oils were: (1) Penna long residuum; (2) refined distillates from asphaltic base oil; (3) refined Russian distillates; (4) oils containing added polar bodies, viz. fatty acids. The coefficient of friction μ was plotted against T. In thin films the heterogeneous character of mineral oils was manifested in a number of inflections in the curves. Oil (1) showed a steady rise in μ up to 140° C., and thereafter a fairly sharp fall. On cooling, the curve was almost flat, and lower than the curve obtained on heating. The curves for oil (2) fall between 60° and 100° C., and then rise sharply. The cooling curve is fairly flat, and higher than that for the original oil. Oil (3) shows an almost linear rise, and μ is lower on cooling. With oil (4) the curve falls steadily to about 140° C. and then rises. The cooling curve is higher than that on the original

oil. On reheating and recooling in situ the inflections become smoothed out and the curves become almost entirely reversible. The same effect was produced by oxidizing an oil by blowing before the test. In the tests conducted in an oil-bath the results show a steady decrease of μ with increasing temperature. The curves are almost entirely reversible on cooling, and re-heating and re-cooling have little effect. The results serve to indicate the profound effects of oxidation and polymerization. It is suggested that the friction in a bearing at any moment depends on the quantity and quality of beneficial polar bodies and the quantity of deleterious asphaltic matter produced by oxidation. The efficiency of a particular lubricant may therefore depend on its ability to produce greater or less amounts of one or both of these bodies during its life in the bearing. H. G.

662.753.1 : 621.43.019.8

401. Relationships between Knock Ratings and the Testing Engine. M. Marder. *Oel u. Kohle*, 1935, **11**, 923–928.—The detonation properties of motor fuels in actual practice cannot be predicted adequately from octane ratings determined in any particular testing engine. The values obtained under different test conditions in the same motor and under identical conditions in different motors are unrelated. The C.F.R. octane no., *e.g.*, is only a measure of knock tendency in that particular engine under the test conditions. A general opinion of the knock tendency of a fuel can be attempted only if certain of its physical properties are taken into account.

The divergence between knock ratings as given by different motors increases with the density (d_{20}) of the fuels. Fuels with high d_{20} are more affected by changes in the test conditions (in a given motor) than those of low d_{20}.

The parachor and d_{20} may be used to correlate differences in octane number arising from different conditions of test. P. G. H.

661.1 : 545.81

402. Measurement of Colour in Fats, Oils and Waxes. L. Ivanovszky. *Ole, Fette, Wachse*, 1936, **1** (4), 1.—A description of the theory, construction and scope of various colorimeters and photometers which are suitable for measurements on oils, fats and waxes. P. G. H.

662.753.1 : 621.43.019.8

403. Allowable Boost Ratio. G. D. Boerlage, L. A. Petetier and J. L. Tops. *Aircraft Eng.*, Dec. 1935, **7** (82), 306.—The difficulties encountered in the knock rating of aviation fuels above 80 octane number led the authors to develop the Allowable Boost Ratio method. This is defined as the ratio of the boost pressure for the sample at incipient pink to the boost pressure of the standard (pure *iso*-octane) at incipient pink.

Fuels with an octane number in the region of 100, when tested in the C.F.R. engine, need a compression ratio of about 10 : 1 in order to give the intense degree of knock required by the C.F.R. test, in which case the normal rapid rate of pressure rise influences the bouncing pin appreciably, apart from the effect of knocking. It is also shown that the increase of power output for a given increase in the octane number of the fuel is much greater if the boost pressure is increased to give incipient knock than if the compression ratio is increased to give incipient knock. Again, the trend in aero-engine design is to increase the boost pressure, and not the compression ratio, which strengthens the authors' view that the Allowable Boost Ratio method is to be preferred for the rating of aviation fuels.

A C.F.R. engine with suitable arrangements for varying the intake pressure was used for the experiments described. The point of incipient knock was detected by ear. The authors are not convinced that the C.F.R. engine is the most suitable for this test.

Data are given comparing Allowable Boost Ratios with conventional octane numbers.

The following advantages are claimed for the Allowable Boost Ratio method: (1) the test conditions approximate more closely to the supercharged aero engine; (2) the scale has no upper limit; (3) the incipient knock is closer to practice than the heavy knock required by the C.F.R. test. J. G. W.

Refining and Refinery Plant.

536.7

404. Application of Physical Data to High-Pressure Processes. W. K. Lewis. *Ind. Eng. Chem.*, 1936, **28**, 257.—The use of the reduced equation of state in correlating P.V.T. data for hydrocarbons is illustrated and discussed. The methods of applying the charts so derived are given when determining internal energy and fugacity. The question of applying deviation charts derived from experimental data on pure gases to vapour mixtures is discussed, and the method evolved by Gilliland (*Ind. Eng. Chem.*, 1936, **28**, 212) is recommended. The charts are based on experimental results on hydrocarbons, and are primarily intended for use on those substances, but the possibility of using them for other substances is illustrated by applying them to steam, ammonia and carbon dioxide. The charts may also be used to correlate the influence of pressure on chemical equilibrium more successfully than the gas laws.

P. D.

621.791.5 : 669.144.3

405. Welding Properties of Corrosion-Resisting Alloys Improved by Columbium. W. J. Priestly. *Nat. Petr. News*, 29.1.36, **28** (5), 29.—Chromium oxidizes readily at high temperature and forms carbides easily, and these facts have produced many difficulties in the welding of chromium and nickel-chrome alloys. It has been found that the incorporation of small quantities of columbium and titanium in the alloy steels and in the welding rods has eliminated the trouble. The use of an adequate quantity of a special flux and the correct blow-pipe adjustment are essential to success. The whole question is discussed at length from a metallographic point of view.

H. G.

665.545.5 : 66.067.12

406. Application of Hyflo-Supercel as a Filter Aid in the Mineral Oil Industry. S. Both. *Petr. Zeit.*, 12.2.36, **32** (7), 5–8.—Hyflo-supercel is a porous diatomaceous mineral powder, and is used as a filter aid in removing acid sludge from mineral oils. It can be applied in all processes in which metal sieves are employed, and its porous nature accelerates the speed of filtration. It effects neutralization to the extent that a smaller quantity of a weaker lye solution is required, water-washing being unnecessary. In dewaxing oils, the requisite quantity is mixed with the dilution medium, cooled and mixed with cold oil shortly before filtration. Emulsions arising in the refining of crude oil can also be removed by filtration through either standard or hyflo-supercel.

W. S. E. C.

31 : 665.51

407. 1934 Statistics for Russian Petroleum. I. K. Balyabo. *Neft. Khoz.*, 1935, **23** (4), 79–82.—The amount of crude oil piped to the refineries was 20,656,000 metric tonnes. The following products were disposed: gasoline and naphtha 2,806,000; kerosine 4,467,000; oil 1,555,000; asphalt 255,000; paraffin 31,000 and coke 20,400 tonnes. This covers the entire Russian oil industry for 1934. For. Petr. Techn.

665.54

408. Chemical Trends in Petroleum Refining. B. T. Brooks. *Chem. Met. Eng.*, 1936, **43**, 10–13.—A general sketch of the various scientific aspects of the petroleum industry with reference to progress.

G. R. N.

665.521

409. High Efficiency Furnaces. A. N. Leibo. *Neft. Khoz.*, 1935, **29**, 72–75.—It is proposed to eliminate the second bank of radiant tubes in pipe stills by arranging single banks in a spiral manner. This would permit the use of angle return bends, which in the case of a rectangular furnace would have a right angle, thus permitting to pass the flow of oil with less obstruction, causing less carbon to be deposited, whilst the removal of the latter can be effected with greater ease. Moreover, a better utilization of the combustion chamber surface will be possible. A number of furnace modifications is suggested.

For. Petr. Techn.

665.521.2 : 66.074.37

410. **Desulphurization of Gasoline and Kerosine.** K. P. Lavrovskii, V. S. Arbuzov and P. V. Puchkov. *Neft. Khoz.*, 1935, **23** (8), 69–72.—The desulphurization of gasoline and kerosine from Sterlitamak crude oil was carried out on a laboratory scale by hydrogenation in the presence of MoS_2 at 400° C. and higher—the consumption of hydrogen was of the order of 0·5–1·0%. For. Petr. Techn.

621.643.4

411. **Wave-Ring High-Pressure Pipe Joint.** Anon. *Engineering*, 1936, **141**, 192.—A description with illustrations of a new type of pipe joint developed by the I.C.I. The essential feature of the joint is the employment of radial pressure instead of axial pressure to effect the seal. The pair of flanges forming the connection have recesses turned in them into which fits a metal ring the inside bore of which equals that of the pipe, and the outside diameter of the ring is turned in the form of a double wave, the crests of which fit the bore of the recesses in the flanges. By the use of this joint it is claimed that very much smaller flanges can be used and enormous pressures can be successfully held. Photographic illustrations are given of joints which have held a pressure of 175,000-lb./sq. in. for 200 hours, in the course of which the joint was dismantled and reassembled forty times without the necessity of touching the joint ring or recess surfaces. Various combinations of ring and seat metals are used for different purposes. C. H. S.

665.54 : 608.3

412. **Patents on Refinery Plant.** J. G. Alther. U.S.P. 2,029,293, 4.2.36. An improved means of heating hydrocarbon oils to conversion temperature is described.

665.54 : 608.3

A. G. Page. U.S.P. 2,029,501, 4.2.36. Method and apparatus for the distillation of oil in which the temperature control is automatic.

665.54 : 608.3

E. W. Gard. U.S.P. 2,029,528, 4.2.36. Apparatus for the fractional distillation of petroleum.

665.54 : 608.3

C. H. Thayer. U.S.P. 2,029,956, 4.2.36. A method and apparatus are described for firing oil-stills. Leakage is minimized from the return bends of the tubes of the still into the header boxes enclosing the bends, by circulating a portion of the flue gases from the still through the header boxes.

665.54 : 608.3

G. B. Coubrough. U.S.P. 2,030,281, 11.2.36. Fractionation of petroleum mixtures containing gasoline and heavier constituents by adding unvaporizable asphaltic residuum and heating the mixture under pressure. The heated mixture is passed to a column at atmospheric pressure, where the gasoline, kerosine and some gas oil are vaporized. The residue is withdrawn and passed without further heating to a second column into which steam is introduced. The gas oil and wax distillate are vaporized and the heavy lubricating stock and asphalt are withdrawn.

665.54 : 608.3

J. S. Wallis. U.S.P. 2,030,485, 11.2.36. An oil-refining apparatus is described in which the heat exchanger, surface condenser, separator, barometric condenser and run-down tank are installed as a single unit, preferably a vertically disposed cylindrical drum. The length of the conduit between the fractionating tower and the treating apparatus is also minimized. Economy in space, heat-loss and air leakage under high vacuum are thereby effected.

665.54 : 608.3

F. L. Meaker. U.S.P. 2,031,610, 25.2.36. This patent concerns an improved form of tubular furnace or heater in a fractional distillation apparatus and fractionating column which is particularly suitable for vacuum operation.

665.54 : 608.3

J. S. Wallis et al. U.S.P. 2,028,305, 21.1.36. Improved tube-still for the pyrolytic treatment of hydrocarbons. W. S. E. C.

Cracking.

665.53

413. Kinetics of Cracking of Crude Oil Fractions. S. N. Obryadchikov and S. Heiman. *Neft. Khoz.*, 1935, **29**, 60–65.—The experiments are described and the results tabulated. It is stated that an increase in the molecular weight of the stock raises the value of the constants for the reaction velocity at identical temperatures and the value of the temperature factor of the reaction velocity. When calculating the energy of activation, accepting gasoline as the only product of the reaction, higher values are obtained than on including all the products of decomposition, thus leading to a lower temperature coefficient of the reaction velocity. The results obtained by calculations are compared with those by other authors, and some discrepancies are brought out and their causes explained. For. Petr. Techn.

665.53 : 608.3

414. Patents on Cracking. V. Stapleton. U.S.P. 2,026,803, 7.1.36. Improvement in low-liquid-level operation of cracking in which the charging oil is introduced into an enlarged reaction zone maintained at cracking temperature and pressure and a separation of liquid and vapours occurs. The liquid is withdrawn from the enlarged zone into two zones, one of low pressure and one of high pressure, where the vapours are condensed. The uncondensed vapours from the low-pressure zone may be compressed and commingled with those leaving the high-pressure zone, and then condensed to gasoline.

665.53 : 608.3

O. Behimer. U.S.P. 2,027,014, 7.1.36. Cracking of liquid hydrocarbons to prevent excess carbon formation by regulating the rate of heating the oil passing through the heating zone, so that the temperature is progressively raised in transit and reaches the desired cracking temperature near the end of the heating coil. The highly heated oil is delivered subsequently to the cracking zone, where the desired temperature and pressure conditions are maintained continuously, the oil is cracked and carbon deposited.

665.53 : 608.3

L. de Florez. U.S.P. 2,027,334, 7.1.36. Cracking and fractionation of hydrocarbon vapours containing constituents of different boiling points. The gases from the separating zone are treated without reduction of pressure with gas oil, while the gases liberated in the flashing or weathering zone are treated with a relatively light condensate, *e.g.* heavy naphtha. The fractions are withdrawn as a sidestream from the fractionating zone. When an intermediate fraction is employed for the purposes of treating the gases withdrawn from the separating or flashing zones or both, it is preferably first stripped before contacting with the gases.

665.53 : 608.3

F. H. Edson. U.S.P. 2,027,355, 7.1.36. Minimizing carbon formation in cracking processes. One part of the charging stock is passed to a soaking drum and contacted with an oil maintained at cracking temperature and pressure, and the remaining part is passed to a separator maintained at a lower pressure and at an elevated temperature. The mixture of oils in the separator is fractionated into four parts, the lowest and highest fractions withdrawn from the system and the two intermediate fractions passed to a cracking coil. The mixture is passed to the soaking drum, where the lower-boiling fractions are heated first and the higher-boiling fractions added when less carbon is formed than by heating the original feed-stock.

665.53 : 608.3

L. Boulanger et al. U.S.P. 2,027,464, 14.1.36. Cracking of tar oils, oils from low-temperature distillation of coal or of bituminous schist oils to recover in particular benzole. The charge is oxidized with diluted ozone, washed with lime-water and

dehydrated. The oils are then vaporized in a retort at a temperature above 800° C., when the major part of the phenols condenses. The vapours are then mixed thoroughly with ozone and nitrogen monoxide and passed into lime-water and magnesia and then through a solution of caustic potash to retain the phenols. The benzole is collected by condensation.

665.53 : 608.3

N. Goodwin *et al.* U.S.P. 2,027,862, 14.1.36. The rate of cracking hydrocarbon vapours is controlled by passing the preheated vapours continuously into a revolving still, forming a single cracking chamber, the diameter of which is at least twice that of the stream while being preheated. The cracking takes place in the presence of a quantity of metal balls which break up the carbon and keep it in suspension.

665.53 : 608.3

A. G. Peterkin, Jr. U.S.P. 2,028,728, 21.1.36. Combined liquid- and vapour-phase cracking process. A furnace provided with two separately fired fire-chambers and a convection-chamber is adapted to receive furnace gases directly from each of the chambers. The latter contain a bank of convection tubes, through which the hydrocarbon streams are passed and subjected to conversion temperature by means of radiant heat.

665.53 : 608.3

J. Carlstrom. U.S.P. 2,028,967–2,028,968, 28.1.36. A lining is described for cracking vessels undergoing treatment at high temperatures, comprising an outer metal shell forming an enclosed chamber with a layer of corrosion-resistant material secured to the interior wall and covered by a sheet of heat-insulating material. Bricks are secured to the sheet, and means are provided for supporting the sheet and bricks, and allowing the shell to expand independently.

665.53 : 608.3

G. D. White. U.S.P. 2,029,601, 4.2.36. In cracking petroleum hydrocarbons, selected fractions having different boiling ranges are first separated, and the separated fractions are subjected to different heat treatments under optimum conditions to produce the desired end-products. The tendency to carbon formation is decreased.

665.53 : 608.3

J. B. Barnes. U.S.P. 2,029,752, 4.2.36. A combined topping and cracking process for petroleum hydrocarbons is described for the production of high anti-knock gasoline.

665.53 : 608.3

W. W. Gary. U.S.P. 2,030,365, 11.2.36. Cracking of hydrocarbon oils in a plurality of stages.

665.53 : 608.3

H. L. Pelzer. U.S.P. 2,030,393, 11.2.36. Cracking of hydrocarbon oils in three fractionating operations.

665.53 : 608.3

C. Still. U.S.P. 2,030,771, 11.2.36. Improved apparatus for the expansion of hydrocarbons for cracking and distillation.

665.53 : 608.3

J. P. Dougherty, Jr. U.S.P. 2,031,591, 25.2.36. Cracking of hydrocarbon oils in which two catalytic converters are arranged for alternate operation on stream and in regeneration.

665.53 : 608.3

J. W. Harrison *et al.* U.S.P. 2,031,600, 25.2.36. Catalytic conversion of hydrocarbons in which the catalytic mass is arranged for regeneration in situ. A battery of catalytic boxes is employed, a portion operating on stream and the rest in regeneration.

W. S. E. C.

Hydrogenation.

66.094.1 : 668.2

415. Patents on Hydrogenation. Chemical Works, formerly Sandoz. E.P. 440,934, 8.1.36. Catalytic hydrogenation of higher carboxylic acids or their esters at a temperature of 250–350° C. and under 250–300 atmospheres pressure, to produce alcohols containing more than 4 carbon atoms. A copper–chromium catalyst is used containing iron oxide as activator.

66.094.1 : 668.2

H. Th. Böhme, A.G. E.P. 441,096, 13.1.36. Hydrogenation of fatty acids in the presence of catalysts, *e.g.* non-metals of fourth, fifth or sixth groups to produce wax esters. The temperatures and pressures used are 280° C. and 150–200 atm. When sulphur is used as a catalyst, it is boiled with quinoline and diluted with xylene. Wax esters are produced, and unsaturated alcohols are obtained by saponifying these unsaturated esters.

66.094.1 : 668.2

S. Metropolitan Gas Co., H. Stanier and R. Leet. E.P. 441,509, 21.1.36. This patent describes an improvement to that of 22.10.34, E.P. 418,235, in which tar oils are hydrogenated at elevated temperatures and 100 atm. pressure, by passing the oils as liquids, together with hydrogen, through a heated tube at such a speed that turbulent flow is produced. The improvement is to pass the products with appreciable temperature reduction into a catalyst chamber in which hydrogenation is continued under conditions not including turbulent flow to favour the production of motor spirit.

66.094.1 : 668.2

H. E. Potts. E.P. 442,385, 7.2.36. Production of benzene by hydrogenation of liquid hydrocarbons boiling above 200° C. and rich in cyclic constituents, at moderate temperatures, using tungsten sulphide as catalyst. The hydrogenation is continued until at least 10% by weight of the constituents boiling above 200° C. remain in the liquid reaction products obtained after cooling the gases or vapours. These constituents are further hydrogenated and the benzenes obtained from both stages are mixed.

66.094.1 : 668.2

W. Rittmeister. U.S.P. 2,029,895, 4.2.36. Hydrogenation of coal and its distillates, tars, cresols, mineral oils and residues, etc., at 200–550° C. and under a pressure greater than 20 atm., using as catalyst molybdenum sulphide dissolved in a primary or secondary amine, *e.g. cyclo*hexamine, piperidine, octadecylamine.

66.094.1 : 668.2

S. A. Kiss. U.S.P. 2,031,961, 25.2.36. An improved method of heating in the destructive hydrogenation of petroleum of wide boiling range is described, in which the petroleum is fractionated into at least two fractions. A lighter fraction containing constituents vaporizing below 700° F. and under pressure above 20 atm., is preheated with hydrogen and passed into an elongated heating zone of narrow cross-section which is maintained at a temperature above 700° F. and at a pressure above 20 atm. The heavier fraction is preheated separately in the absence of hydrogen above 700° F. and under a pressure greater than the critical homogeneous pressure of the fraction. The separate cuts are discharged into a reaction vessel under a pressure greater than 20 atm. W. S. E. C.

Crude Oil.

665.51.66(496.5)

416. Albanian Petroleum. W. Ciusa. *Olii Min.*, 1936, **16**, 1–2.—Tests are given of three samples of crude oil and of the various fractions obtained from them. The proportion of the gasoline fraction varies from 2·7 to 9·8%, whilst the total distillates below 310° C. were 48·6, 42·2 and 57·9%. Asphalt contents are high (20·7, 10·6 and 11·2%), and sulphur varies from 2·2 to 4·1%. C. C.

Gas.

665.511 : 536.7

417. **P.V.T Relations of Gas Mixtures.** E. R. Gilliland. *Ind. Eng. Chem.*, 1936, **28**, 212.—The P.V.T. relations of gas mixtures can be calculated from the slope of the isometric of the mixture and the internal pressure. The former may be calculated from the molal average of the isometrics of the constituents all measured at the same molal concentration. The method of estimating the internal pressure is also given.

The accuracy of the method is demonstrated by calculations for three gas mixtures, one of which is given in full as an illustration, and it is shown that the agreement with the experimental data is better than with either Amagat's or Dalton's laws, and is probably within the experimental error. P. D.

665.58 : 608.3

418. **Patents on Gas.** M. Halpern, W. B. Logan, R. E. Manley and W. Ullrich. U.S.P. 2,030,030, 4.2.36. Pyrolysis of natural or refinery gases to produce in a two-stage process, high anti-knock motor spirit and lubricating oil of good quality. The gases are cracked into olefines in the first stage, and then these are polymerized in the presence of an adsorptive catalyst, *e.g.* montinorillonite clays containing 50–100% of particles finer than 200 mesh and 5–25% of a filter aid, *e.g.* diatomaceous earth. The gases are maintained during polymerization under a pressure of 200–5000 lb./sq. inch. W. S. E. C.

Motor Fuels.

665.582.2

419. **Manufacture of Polymer Benzine.** R. Heinze. *Oel u. Kohle*, 1936, **12**, 185.—A description of processes in current use in U.S.A. Data relating to yields and properties of the products, particularly octane rating, are given. P. G. H.

665.581.095.26 : 547.214

420. **Butane Demand Soaring as Polymerization Expands.** T. F. Smiley. *Oil & Gas J.*, 9.1.36, **34** (34), 9.—It is considered that demand for butane will show a great increase owing to installation of polymerization plants. One such plant is already in operation and 4 others are under construction. The intake of the 5 plants will be equivalent to approximately 365 million gallons, as compared with an estimated consumption in 1935 of about 34 million gallons of butane for other purposes. Pipe-lines will be used to transport the butane for these plants.

Sales of butane for domestic purposes have increased, but propane is likely to be of more importance in this market. In the industrial market butane is being employed for an increasing number of purposes owing to its advantages where consumption is large and an economical, clean and easily controlled fuel is needed.

A list is given of some of the major applications of the fuel in industry, *e.g.* in metallurgical operations, glass manufacture, enamelling, floodlighting, etc. As fuel for internal-combustion engines the application of butane is restricted mainly to stationary engines, but it is believed that the fuel could be used with advantage in the operation of railway cars and trucks provided a high-compression type of engine were used. The consumption of butane for gas-making purposes appears to be declining. R. A. E.

662.754

421. **National Carburant.** I. Doynel. *Bol. Inform. Petroleras* (*B.A.*), Dec. 1935, 12 (136), 129–153.—In 1898, M. Leprête put on the market, under the style "Electrina Leprête," a 50% mixture of alcohol and benzole. It was used for a time in the Paris 'buses, but the high price of alcohol prevented its general adoption.

During the Great War the manufacture of smokeless powder caused a demand for alcohol in bulk and a fount of joy was changed into a prime agent of death and destruction. Following the war, a surplus of alcohol accumulated, and it became essential to find a use for it, particularly in France. As this country lacked indigenous petroleum, its possible use as a motor fuel was examined, and in 1923 Sarrault's "National Carburant" was brought out. Similar alcohol mixtures appeared, almost

simultaneously, in London and Berlin. These mixtures contained, at first, 30% of gasoline, which was afterwards increased to 50%.

A gasoline mixture rich in alcohol is more stable than an alcohol-poor one, and stability at low temperatures is much greater, for the same proportions, when the alcohol is free from water. Owing to the difficulty of obtaining absolute alcohol, early manufacturers attempted to use rich mixtures of commercial alcohol (95° G.L.), but it was found that mixtures containing more than 50% of alcohol did not function properly unless a special carburettor was used, thus rendering them unsuitable for universal adoption. The problem thus became one of stabilizing alcohol-poor mixtures which would function with standard carburettors, and this object was attained by the addition of ether or benzole. Sulphuric ether is superior to benzole in this respect, as 5% of it homogenizes a mixture of 25% alcohol and 75% gasoline.

The situation in France is peculiar. Importers are required, legally, to buy from the State an amount of alcohol equivalent to 10% of the gasoline they import. This alcohol costs the state 250 francs per 100 litres, but, in order that it may be blended into a mixture selling at a competitive price, it is sold to the importers at 120 francs. Furthermore, the supplies of alcohol available for blending amount to only 3% of the gasoline imports. A 3% alcohol mixture is unstable in normally damp atmospheres, and so the state has decreed the percentage as 30. How can a 30% mixture be produced when only 3% of the necessary ingredient is available? Easily! All the available alcohol is blended with 70% of gasoline, and the surplus gasoline is sold, either unadulterated or mixed with heavier hydrocarbons, as a "national carburant" carrying a special brand.

The advantages and disadvantages of alcohol as a carburant are dealt with at some length. The opponents of alcohol-mixture carburants claim that, volume for volume, straight gasoline gives more energy; that oxidation occurs in valves and cylinders where alcohol is used; that the mixture becomes unstable through the absorption of atmospheric moisture; that starting is difficult in cold weather; and that alcohol is liable to damage the finish of coachwork. On the other hand, its supporters claim that simple precautions and slight modifications are all that is necessary to overcome the alleged defects; that it gives smoother running and develops greater power, particularly in engines of large size and high compression. Furthermore, it is shown that, on theoretical grounds, alcohol mixtures produce a gas, with air, possessing greater energy per unit volume than that produced from straight gasoline. In practice, also, it is found that the actual energy produced, considered as a percentage of the theoretically possible, is greater with alcohol than with gasoline. In Berlin, results of tests gave the respective percentages as 24·8 and 14–18, whilst an Argentine commission placed the figures as 30 and 16–20. A further advantage of alcohol is that it is not merely a non-detonant, in the pure form, but it is also a powerful anti-detonant in mixtures.

In the Argentine, 93 million litres of the gasoline consumed annually, representing 13% of the total, is of foreign origin. The net cost of this gasoline, c.i.f., and of gasoline produced locally by foreign interests, may be taken as about 9 centavos per litre.

Absolute alcohol, distilled locally from corn, would cost at least 10·5 centavos, net, per litre, but it could be produced from sugar-cane at 6·5 centavos per litre. Alcohol, at this price, could be used with advantage to replace the imported gasoline, and the nation would benefit morally and financially.

If it is assumed that 60% of the present consumers of straight gasoline in the Argentine would change over to a mixture containing 30% of alcohol, this would represent an annual consumption of 144 million litres of absolute alcohol. The sugar areas of Northern Argentine would be capable of supplying 25 million litres, leaving 119 million litres to be obtained from other sources.

The paper contains the following tables: (1) gasoline–alcohol mixtures; (2) carburants without alcohol; (3) test of alcohol fuels on the Turin Circuit; cost of absolute alcohol; (4) methods of obtaining commercial absolute alcohol; and (5) alcohol-mixture carburants. L. O.

662.753.12

422. Road Tests on Highly Volatile Gasolines. G. G. Brown. Part I. *Oil & Gas J.*, 16.1.36, **34** (35), 38.—A 1934 model Master Chevrolet was chosen as representative of

a large number of cars on the road and of a modern power plant which can be readily operated at low mixture temperatures. Mileage, top speed and acceleration tests were conducted under carefully controlled conditions.

The carburettor used included a replaceable orifice through which a tapered metering pin operates to control the supply of fuel, and an accelerating pump of variable stroke. Suitable adjustments to give best results for each fuel for mileage and acceleration were found, and tests made under these conditions as well as with factory adjustments.

An octane selector was available, and when set at 0 (equal to 65 octane number), mileage tests at atmospheric temperatures of 25–95° F. showed that: (1) with factory carburettor adjustments maximum mileage is obtained with the least volatile fuel. (2) This mileage may be equalled with a more volatile fuel by proper adjustment. (3) No loss in mileage with fall in temperature with the same carburettor adjustment. (4) Density may be used as a direct indication of mileage obtainable at part throttle from fuels of the same general character, but not when comparing fuels of different chemical nature. Fuel properties and relative average mileages at constant speeds from 10 to 75 m.p.h. at atmospheric temperatures of 60–85° F. with most economical carburettor adjustments may be summarized :—

Fuel number . .	1	2	3	4
Octane number .	65·9	65	65·6	69·4
Volatility number .	146	86	24	47
A.P.I. grav. in ° .	78·1	66·1	65·1	61
Relative density .	0·9377	0·995	1·00	1·0215
Relative mileage .	0·946	0·994	1·00	0·985

Fuel 4 was a leaded fuel. Volatility number is determined by subtracting the temperature of the 50% point from 284° F.

Part II. *Oil & Gas J.*, 23.1.36, **34** (36), 28.—Maximum speed tests with various positions of the octane selector and with unheated and normally heated intake manifold show that the use of an unheated manifold: (1) increases maximum speed by 2%, other conditions being identical, and this corresponds to the increase obtained by raising fuel knock rating by 25 numbers with heated manifold and advancing the octane selector by 14°, (2) with a volatile fuel and suitable adjustments maximum speed is increased by 2½% and mileage at top speed by 10%, compared with a less volatile fuel used with factory adjustments and heated manifold.

Acceleration tests with octane selector at 0 and heated manifold show: (1) with suitable adjustments all fuels give similar accelerations at atmospheric temperatures of 50–85° F. (2) At atmospheric temperatures of 40° F. and lower, acceleration with fuel 3 decreases, and at 20° F. the decrease amounts to 20%; with fuel 1 acceleration improves with lowering of atmospheric temperature by about 6%. Acceleration tests with unheated manifold at an atmospheric temperature of 60° F. show further slight improvements with fuel 1. Much data regarding manifold and mixture temperatures obtained during the maximum speed and acceleration tests are made available.

The effect of octane selector position on required octane number and relative performance in regard to average acceleration, maximum speed and average mileage was then determined with heated manifold. The gain in average acceleration obtainable by an increase of 25 octane numbers can be equalled by decreasing the temperature of the mixture as it enters the intake port by about 50° F., and using a correspondingly more volatile fuel of the same octane number. The increase amounts to about 11·5%, which agrees well with results of previous investigations.

Limitations which prevent some cars utilizing volatile fuels to the best advantage should be removed. They are (1) improper fuel systems, giving rise to vapour lock, (2) automatic chokes that flood the carburettor. R. A. E.

662.753.12 + 547.214

423. Mileage with Butane Lower than with Gasoline. Anon. *Nat. Petr. News*, 29.1.36, **28** (5), 28.—Conclusions are reached from the results of running 5 vehicles on liquid butane and 4 on gasoline. With ordinary regulators and plain tube venturies in the carburettors mileage with butane was lower than with gasoline. Alterations in the carburettor are expected to increase efficiency. General road performance in power

and acceleration were found to be good with butane. Lower lubricating-oil consumption was experienced, and dilution was negligible. Other characteristics observed were high octane number, detonation at high compression ratios, and a sensitiveness to spark advance necessitating exceptionally cold spark plugs to eliminate head gasket failures. H. G.

662.754

424. Alcohol Motor Fuel. T. Suiva. *J. Fuel Soc. Japan*, 1935, **14** (159), 129–132.—The use of ethyl alcohol mixed with commercial gasoline as a motor fuel was studied on a C.F.R. engine coupled to a 4-kW. Sprague dynamometer. Engine conditions were speed, 900 r.p.m.; mixture strength, max. power setting; throttle opening, full; jacket temperature 100° C.; mixture temperature 40° C. Three blends containing respectively 10, 20 and 30% by vol. of absolute alcohol were employed. With a fixed C.R. (5·3) and ignition advance 25° before top centre the power obtainable from the blends was lower than that from the gasoline and the fuel consumption per H.P. hour increased with the percentage of alcohol. With a fixed C.R. (5·3) and suitable retardation of the ignition, advance power output and fuel consumption of the blends up to 20% were as good as those for gasoline. By suitable variation of the C.R. and ignition advance power output increased with the percentage of alcohol. It was concluded that alcohol should be appraised not lower than gasoline when it is used in blends up to 20%. Taking the time for the engine speed to increase from 750 to 900 r.p.m. at full load on fully opening the throttle as a measure of acceleration, it was found that up to 20% alcohol in the blend gave results as good as those of gasoline, and when the percentage was further increased the acceleration became poor. Experiments on ease of starting showed that blends containing up to 20% alcohol gave the same results as gasoline. G. R. N.

662.754

425. Experiments with Alcohol Fuels. S. Saijo. *J. Fuel Soc. Japan*, 1935, **14**, 133–134.—These are summarized as follows: (1) Alcohol as a base fuel: 94–95% alcohol can be used without modification of the engine. It tends to lower the mixture temperature than in the case with gasoline, as the heat of vaporization is higher. The lowest temperature allowable for starting is 10° C. and 0° C. if primed in the cylinder; blends with ether or gasoline permitted lower starting temperatures. Fuel consumption is higher than with gasoline, but the rate of reduction with the increase of compression ratio is greater (table given). (2) Alcohol–gasoline blends—99·8% alcohol must be used. As regards starting and handling, there are no special differences between gasoline, and the blend and road tests show there are also no great differences in output and fuel consumption. A table is given showing the variation in output and consumption with increases in speed and compression ratio for three blends. G. R. N.

662.754 : 620.191

426. Corrosion of Metal by Alcohol Fuels. K. R. Dietrich and W. Lohrengel. *Oel u. Kohle*, 1936, **12**, 91.—The action of mixed alcohols (95% ethyl: 5% methyl) and 10% blends of this with cracked benzine on 20 metals (iron, plated iron, aluminium, and special alloys) was studied. The change in weight of test-pieces was measured at weekly intervals. The alcohol mixture had no action except in the case of iron, lead-plated iron, Silumin and Elektron. The two last-named soon acquired a protective film which prevented further action. Iron and lead-plated iron were stated to be quite unsuitable for alcohol containers. Benzine–alcohol mixtures showed the same general behaviour, but in this case iron formed a protective layer. The addition of benzine to the alcohol mixture accelerated the corrosion of lead. The formation of lead alcoholate is stated to occur more readily in methyl than in ethyl alcohol. P. G. H.

662.753.22

427. Cracked Kerosine as Tractor Fuel. R. A. Virobyantz, P. A. Kudryavtzev and Z. V. Veksler. *Neft. Khoz.*, 1935, **28** (3), 37–45.—Winkler–Koch cracked kerosine

in Baku with 10% over below 200° C. and an end-point of 300° C., octane number 40, is a suitable tractor fuel when treated with 1% H_2SO_4 and redistilled, and also when mixed with straight-run Baku kerosine. The Maikop kerosine as such or in admixture with Baku cracked kerosine is unsuitable. A great variety of experiments are described. For. Petr. Techn.

665.521.2

428. **"Reforming" Process.** M. Gerasimov and L. Mukhin. *Neft. Khoz.*, 1935, **23** (5), 68.—The latent heat of the reaction that takes place in the reforming process was derived from the heats of formation of gasoline, calculated by the Obryadchikov method (cf. *Chem. Abs.*, **26**, 1104) and amounted to — 148 cals. per kgm. for the material investigated. For. Petr. Techn.

665.582.2

429. **The Thermal Conversion of Hydrocarbon Gases to Gasoline.** P. C. Keith, Jr. and J. T. Ward. *Oil & Gas J.*, 28.11.35, **34** (28), 36; *Refiner*, 1935, **14**, 506.—The history of investigations which have been carried out in the conversion of hydrocarbon gases to liquids is surveyed. Processing methods may be divided into 5 general groups: (1) High-temperature low-pressure cracking to unsaturates; (2) high-temperature low-pressure pyrolysis of saturates and unsaturates primarily to produce aromatics; (3) non-catalytic polymerization of gaseous olefins; (4) catalytic polymerization of gaseous olefins; (5) methods, such as alkylation, for affecting combination of saturates and unsaturates. Reactions in the fifth group differ from those of the others in that: (*a*) it is indicated that under certain conditions the supposed chemical inertness of saturated compounds may be overcome and they may be made to act directly; (*b*) emphasis is shifted from the production of aromatics to that of aliphatic and relatively stable olefins.

The evolution of a unitary non-catalytic process for the production of motor fuels, in which the raw charging stock is treated as a liquid rather than a gas, and processed in the highly condensed phase, is described. Evidence to prove the direct reaction of saturates with unsaturates is produced.

A pilot plant operating on a mixture of 60% propane and 40% *n*-butane at 1200 lb. pressure and a temperature of 1,035° F. gave a liquid yield of 59% by weight, the raw product having an E.P. of 456° F. and an octane number C.F.R. motor method of 89.

A commercial plant has been in operation in Texas for an extended period, and the operating time between clean-outs varies from 50 to 60 days. The feed-stock consists largely of butanes. The feed-stock of a unitary plant may vary from propane or butane to a complex mixture of C_3C_3 and C_4 compounds in which unsaturates amount to as much as 80%. The polymerization portion of the unit will vary with feed composition only in regard to arrangement of reaction coil surface, but the gas and cycle-stock recovery system will vary with feed composition for lowest operation costs. A typical flow sheet is given. Fuel consumption varies from 6 to 10%, but will be reduced if the plant is made part of a cracking unit. The composition of the final product will vary with feed composition, tending to be more paraffinic with lower unsaturates in the feed. The gasoline is easily refined to commercial standards by clay or acid. In the case of a refinery gas containing 22% of unsaturates and costed as equivalent to fuel on a B.Th.U. basis, it is estimated that a plant handling 25 million cu. ft. a day can produce gasoline at a cost of 3½ cents per gal.

R. A. E.

665.521.2

430. **Phosphorus Pentoxide as a Refining Agent for Gasoline.** B. W. Malishev. *Ind. Eng. Chem.*, 1936, **28**, 190.—The refining action of phosphorus pentoxide (P_2O_5) on gasoline is due to its catalytic effect on the direct alkylation of aromatic hydrocarbons with olefine hydrocarbons; to the conversion of olefines into naphthenes, and to the partial polymerization of the olefines themselves. The alkylation reaction proceeds most readily owing to the presence of aromatic hydrocarbons.

An appreciable increase in octane number is observed when certain cracked dis-

tillates are refined with P_2O_5, which is explainable by the alkylation reaction, whilst objectionable chain and cyclic diolefines are removed.

Pure olefines are polymerized by P_2O_5, but in the presence of aromatic hydrocarbons the reaction is retarded and, in fact, diisobutylene in benzene solution is depolymerized, since the chief product is isobutyl benzene.

The different effect of P_2O_5 compared with metaphosphoric acid is shown by the polymerization of ethylene at 50 atmospheres and 250° C. to a mixture of olefines, naphthenes, paraffins and aromatic hydrocarbons of the gasoline range.

The method of operation suggested for gasoline refining consists in passing the vaporized cracked distillates through a stirred heated suspension of P_2O_5 (1–2%) in heavy unrefined mineral oil. The consumption of P_2O_5 amounts to about 0·1–0·25% on the gasoline treated. F. E. A. T.

665.521.2

431. Composition of Straight-Run Pennsylvania Gasoline. C. O. Tongberg, D. Quiggle and M. R. Fenske. *Ind. Eng. Chem.*, 1936, **28**, 201.—The careful fractionation of a Pennsylvania straight-run gasoline, a West Virginia natural gasoline and a Michigan straight-run gasoline are described; a still charge of about 40 gallons being fractionated through a 30-foot column using a high reflux ratio (26 to 1) over a period of about six days.

Variations in refractive index, octane rating, etc., are plotted, together with the distillation curve, and illustrate the greater complexity of the Pennsylvania gasoline in comparison with the Michigan gasoline, which is shown to contain a greater amount of *n*-paraffins and aromatics, but a smaller amount of branched paraffins than the Pennsylvania product.

Alternative methods of preparing high anti-knock fuels by efficient fractional distillation from straight-run gasolines are reviewed. F. E. A. T.

665.521.2 : 66.095.26

432. Cracked Gasoline Polymers. A. Y. Larin. *Neft. Khoz.*, 1935, **28** (6), 57–62.—Polymerization products were separated from $ZnCl_2$ vapour-phase treated cracked gasoline polymers, unrefined cracked residues, "pyro" gasoline and "green" oil (the heavier fractions obtained in the pyrolysis of petroleum) by vacuum distillation. The separated polymers were of solid consistency, and were found to be suitable softeners for rubber (permitting thorough vulcanization), good varnish and paint substitutes and representing a high-grade electrical insulating material. The experiments are described in detail. For. Petr. Techn.

662.743 : 608.3

433. Patents on Motor Fuel. M. A. Matthews, L. G. B. Parsons and I.C.I. Ltd. E.P. 440,456, 31.12.35. Destructive hydrogenation of carbonaceous materials to produce liquid hydrocarbons in the presence of hydrogen halides. The halogen in the stable halides formed during the treatment is rendered available for further use. These stable halides are subjected to the action of a compound of an alkali or alkaline-earth metal and decomposed with inorganic acids soluble in water and capable of expelling the hydrogen halides from their salts or the ammonium salts of these inorganic acids.

665.521.2 : 608.3

Naam. V. de Bat. Petr. Maat. E.P. 440,517, 1.1.36. Manufacture of hydrocarbon distillates by fractional distillation and/or condensation of hydrocarbon mixtures in which a partly heated hydrocarbon mixture is introduced continuously between the bottom and top of a column. The vapours are contacted with a counter-current reflux, and the fractions are removed from the top, bottom and other parts. Further heat is then applied to the column at different levels, so that the boiling range of the heaviest distillate and that of the residue do not overlap.

665.521.2 : 608.3

N. V. de Bat. P.M. E.P. 441,104, 13.1.36. Separation of non-lubricating hydrocarbon oils into their components by previously mixing the oil with a saturated

hydrocarbon, *e.g.* propane, and then extracting with a selective solvent flowing counter-current. The three liquids in question have different boiling points, initial material, hydrocarbon solvent, selective solvent, increasing in boiling point in the order given.

662.753.21 : 668.3

Soc. des Établ. Barbet. E.P. 441,518, 21.1.36. Treatment of crude benzoles to extract practically the whole of the sulphur by physical means. The crude benzole is rectified in a column containing plates to extract the carbon bisulphide which escapes from the top of the column. In a second column, very light products, boiling before carbon bisulphide, and carbon bisulphide are removed; the residual liquid from the second column is passed to a third column in which benzole and toluol are separated. A cut rich in thiophen is removed towards the top of the column.

665.521.2 : 668.3

J. F. Wait. E.P. 441,703, 20.1.36. Treatment of petroleum oils spirits to render them more stable to oxidation. They are subjected to mild oxidation and subsequent treatment with sodium metal at 250–500° C., and the purified oil is separated from the impurities formed. The light metal or compound is obtained by the direct result of electrolysis, and applied immediately by circulation through a tower through which the oil-vapours are passed. The impurities are continuously removed from the tower.

665.53 : 668.3

O. E. Roberts, Jr. U.S.P. 2,027,552, 14.1.36. Method described for decreasing the quantity of free carbon and fixed gases formed in cracking processes. The separate fractions of the overhead distillate are treated in the vapour phase in the presence of a catalyst consisting of a metal alloy containing a univalent metal, *e.g.* lead and antimony or tin, tin, copper and antimony, etc.

665.58 : 668.3

M. Pier, W. Simon and W. Kroenig. U.S.P. 2,028,348, 21.1.36. Hydrogenation of coal, mineral oil, middle oil or tar at 440° C. and under 200 atmospheres pressure in the vapour phase using as a catalyst molybdenum bromide and tungsten sulphide. Motor spirit, diesel oil, kerosine and lubricating oil are obtained as products.

665.54 : 668.3

A. V. Gruse. U.S.P. 2,029,100, 28.1.36. Refining of hydrocarbon oils containing sulphur by treating them with hydrogen in the presence of pre-formed cobalt tetrathiomolybdate to cause it to react with the sulphur compounds in the oil, and in the absence of hydrogen sulphide other than that evolved by the reaction and from the oil.

665.581.44 : 668.3

M. P. Yonker. U.S.P. 2,027,460, 14.1.36. Natural gas conversion into liquid hydrocarbons by allowing the gases to flow through a tube under a pressure in excess of 500 lb./sq. in. and at a temperature above 750° F. The gaseous material is converted into a mixture of liquid and fixed gas and an intermediate product. A hydrocarbon liquid rich in carbon is added to the gaseous material and cracked. The fixed gas is removed, and the intermediate product is then treated similarly.

665.54 : 668.3

J. C. Morrell. U.S.P. 2,027,648, 14.1.36. Refining light distillates from cracking processes by subjecting them to the action of acetic acid and then concentrated sulphuric acid.

66.074.7 : 665.521.2 : 668.3

R. J. Dearborn and W. M. Stratford. U.S.P. 2,028,100, 14.1.36. Refining of hydrocarbon vapours containing unsaturated compounds by passing them through a solid adsorptive clay catalyst. The unstable compounds polymerize and the polymer products are condensed.

665.521.2 : 608.3

O. P. Cottrell. U.S.P. 2,028,121, 14.1.36. Continuous process for converting straight-run gasoline into gasoline of high octane number. The gasoline is separated into a high- and a low-boiling fraction. The high-boiling fraction is SO_2-treated, the raffinate and extract removed and solvent recovered. The raffinate is mixed with cracking stock, and the mixture cracked to form cracked gasoline, which is then mixed with straight-run gasoline. The extract is blended with the low-boiling fraction to produce gasoline of high octane number.

665.53 : 608.3

V. Kalichewsky. U.S.P. 2,028,335, 21.1.36. Sweetening of cracked distillates by treatment with an anhydrous mixture of caustic soda and caustic potash.

66.074.7 : 665.521.2 : 608.3

F. M. Rogers. U.S.P. 2,028,995, 28.1.36. Removal of sulphur compounds from gasoline by contacting with a solid adsorbent catalyst, *e.g.* clay at 650–750° F. at a rate of 12–20 brl. of oil per hr./ton of catalyst.

665.521.2 : 608.3

W. A. Schulze and L. V. Chaney. U.S.P. 2,028,998, 28.1.36. An improved method is described to sweeten petroleum hydrocarbon oils containing mercaptans. The oils are treated with hypochlorite to convert the mercaptans into disulphides and alkyl sulphur chlorides, the latter remaining in the oil. The oil is separated from the hypochlorite solution and contacted with a strong reducing solution of caustic soda and potassium cyanide. The alkyl sulphur chlorides are then reduced to disulphides, and the sweetened oil is removed from the reducing solution.

665.521.2 : 608.3

J. C. Morrell. U.S.P. 2,029,115, 28.1.36. Refining of gasoline by treatment in the vapour-phase with a solution containing sulphuric acid to effect a substantial refining. A sulphonated olefine hydrocarbon is added to dilute the sulphuric acid.

665.521.2 : 608.3

R. B. Day. U.S.P. 2,029,256, 28.1.36. Refining of cracked gasoline by treatment at 200–600° F. and under 100–200 lb./sq. in. pressure with aqueous hydrogen chloride in the presence of a natural clay containing zinc. W. S. E. C.

Lubricants and Lubrication.

621.892.096.1

434. Atlantic Completes Severe Road Tests on Motor Oil Containing Additive. T. G. Delbridge. *Oil & Gas J.*, 16.1.36, **34** (35), 28.—It has been found that a lubricant consisting of 99% of petroleum oil and 1% of a non-chlorinated ester of phosphoric acid can reduce wear in an average high-compression engine by 40% at the point of most severe wear. Road tests recently carried out confirm laboratory tests. Six automobiles, 2 Chevrolets, 2 Fords and 2 Standard Plymouths were purchased for the tests. A certain 80-mile run was selected for its convenience and average conditions, and the drivers employed represented, in age and previous driving experience, a cross-section of the motoring public. Each car was driven continuously for 6 days a week over a period of 5 months, at an average speed of 20 m.p.h., with a max. of 50 m.p.h. Cars were lubricated and crankcases drained daily, and essential checking of condition was carried out every 5000 miles. Other conditions of test and major repairs and maintenance operations carried out are detailed. No carbon was removed from any motor at any time, no adjustment or repair to transmission was made, and no maintenance was given to any cylinder wall, piston, piston ring, connecting-rod bearing or main bearing, during the test period. Total mileage covered was 600,000, and the test period covered 5 months of varying weather conditions. Main results of the tests may be summarized :—

(1) Oil consumption averaged 565 miles per quart. (2) Gasoline consumption averaged 20·9 m.p.g. (3) Compression pressure averaged 116 lb. per sq. in. at the start and 120 lb. per sq. in. at the finish. (4) Acceleration from 15 to 40 m.p.h. at finish was within ½ sec. of acceleration at the start. (5) Cylinder wear averaged (max.)

0·0007 in., which is less than normal expectancy for one-tenth the distance travelled. (6) Piston-ring gap increase averaged 0·012 in. (7) All piston rings free in grooves, cylinder walls highly polished, combustion chambers contained but slight carbon deposits, engines practically free from sludge.

The history of the research leading to the development of the additive is given. The substance increases the film strength of a refined oil by 200%. Graphs summarize the results, and photographs of engine parts at the conclusion of the tests are presented.

R. A. E.

621.892.096.1

435. Tests on Aero Oils. D. Y. Kolomatzkii and L. V. Zhirnova. *Neft. Khoz.*, 1935, **28** (5), 58–62.—An oil obtained by treating Surakhanui bright stock with nitrobenzene was compared in an air-cooled 650-H.P. aviation motor (on the bench) with Surakhanui and Emba bright stocks. It was found that the solvent-refined bright stock was much superior in comparison with the other oils. The experiments are described.

For. Petr. Techn.

621.892.099.21

436. Service Tests must Determine the Value of Extreme Pressure Lubricants. I. A. Ebaugh. *Nat. Petr. News*, 8.1.36, **28** (2), 21.—The article comprises a brief discussion of the many theories which seek to explain the mechanism of lubrication. The polar theory of boundary lubrication is developed into a discussion of "oiliness" and "extreme pressure" dopes, while stressing the essential difference between the two. It is suggested that great caution is needed in regard to many "oiliness" dopes. Many are definitely harmful in use, and the observation is made to the effect that none can be regarded without some doubt and possible misgiving. The results produced by the many "oiliness" and E.P. testing machines are not capable of intercorrelation, and it is suggested that in no case does any particular machine yield data which is a reliable guide to the behaviour of a lubricant in practice. It would appear that the E.P. dopes all have some drawback. The lead-soap type emulsify and aerate readily, the chlorinated type tend to increase corrosion, and those containing S and sulphurized constituents sludge readily. These, it is pointed out, are the factors which testing machines of necessity ignore, so that until satisfactory laboratory tests are developed the ultimate criterion of any lubricant must be the complete practical test under average service conditions.

H. G.

621.892.211

437. Low Volatility in Lubes is Extremely Important. L. A. Danse. *Nat. Petr. News*, 18.12.35, **27** (51), 38.—As a result of the higher average road speeds now obtaining for motor-cars investigation has shown that the consumption of oil is dependent on the volatility, other factors being equal. As the result of investigations started three years ago, the average volatility of crankcase oils have been reduced considerably. This factor is now considered to be one of the most important in adequate specifications for those oils.

H. G.

621.892.26

438. Product Uniformity a Serious Problem for Grease Makers and Users. C. R. Ahlberg. *Nat. Petr. News*, 11.12.35, **27** (50), 54.—Sundry theories relative to the causes of the instability of greases are reviewed. They comprise considerations of acidity and the production in storage of acidic bodies, hydrolysis, oxidation and the activity of bacteria and enzymes. The results of a questionnaire circulated among makers indicated a great diversity of opinion as to the cause. The author suggests that much more uniform results would be obtained if the raw materials were chosen with greater care and only "stable" mineral oil and "good-class" fatty acids used. He has estimated "active" and "inactive" acids in greases by a method described, and fixes limits for the permissible amounts of these bodies in a satisfactory grease.

Inactive acids are specified as those containing more than 10 C atoms. A plea is made that manufacturers should make greater efforts to ensure greater uniformity in their products.

H. G.

665.521.5 : 66.061.5

439. Solvent Refining of Cylinder Oil Distillate. A. M. Ravikovich and E. S. Luisenkova. *For. Petr. Techn.*, 1935, **3**, 567–576.—From experiments with a cylinder oil distillate of Grozny mixed-base crude from an Alco unit, the following conclusions were reached. Phenol treatment yields finished oils not needing an additional acid or clay treatment. Phenol treatment in propane solutions must be carried out after dewaxing. This yields oils of better quality, and the filtration of the dewaxed solutions proceeds more rapidly. An increase of the pour point of thoroughly dewaxed oils does not occur after a phenol treatment. When refining the oils with phenol-propane, the loss in valuable viscous fractions is lower than in the treatment without the solvent. The oil obtained from phenol-propane treatment, despite its good qualities and stability (Sligh No. = 0), has an unsatisfactory viscosity index. To rectify this it is necessary to treat with additional phenol at higher temperatures, with subsequent reduction of yield. G. R. N.

665.521.5 : 66.061.5

440. Computations for Counter-Current Solvent Extraction Processes. T. G. Hunter and A. W. Nash. *J.I.P.T.*, 1936, **22**, 49–56.—A paper with discussion (on pp. 105–111) on the use of triangular co-ordinates to compute equilibria that may be attained in the systems resulting from the solvent extraction of petroleum products. G. R. N.

665.521.5 : 66.061.5

441. Characteristics of Solvent Refined Motor Oils. S. J. M. Auld. *J.I.P.T.*, 1936, **22**, 57–77.—A paper with discussion (on pp. 105–111) on the beneficial effects accruing from the solvent extraction of lubricating oils, with especial reference to the Duo-Sol process as indicated by laboratory and engine tests. G. R. N.

665.521.5 : 66.061.5

442. Solvent Extraction Processes. W. R. Wiggins and F. C. Hall. *J.I.P.T.*, 1936, **22**, 78–98.—The better-known solvent-extraction processes in commercial use are described (discussion on pp. 105–111). G. R. N.

665.521.5 : 66.063.6 : 668.3

443. Patents on Lubricating Oil. E. I. Du Pont de Nemours & Co. E.P. 440,575, 2.1.36. Manufacture of water-in-oil emulsions by emulsifying water in oil in the presence of a lead salt of a sulphuric acid ester of a normal primary alcohol having at least 8 and preferably 12–18 carbon atoms.

665.521.5 : 66.061.5 : 668.3

N.V. de Bat. Petm. Mij. E.P. 441,105 and 441,136, 13.1.36. Separation of lubricating oils into components by mixing the oil previously with saturated hydrocarbons, and then introducing the mixture into an extraction system in which the saturated hydrocarbon and selective solvent flow counter-current. The three liquids—namely, selective solvent, *e.g.* furfural, hydrocarbon solvent, *e.g.* propane, and initial material—have different boiling points increasing in the order given.

665.521.5 : 668.3

Resinous Products Chemical Co. E.P. 440,916, 8.1.36. Products resembling lubricating oil are prepared by condensing a chlorinated paraffin hydrocarbon containing at least 12 carbon atoms with an aromatic ether, *e.g.* diphenyl oxide, in the presence of anhydrous aluminium chloride.

665.521.5 : 66.061.5 : 668.3

Standard Oil Co. (Ohio). E.P. 441,705, 24.1.36. Solvent extraction of lubricating oils using liquid SO_2 and benzole.

665.521.5 : 668.3

D. E. Payne. U.S.P. 2,026,651, 7.1.36. Dewaxing of lubricating oils using a propane–butane diluent.

U. B. Bray and C. E. Swift. U.S.P. 2,026,729, 7.1.36. Production of lubricating oil by solvent extraction using nitrobenzene and propane, propane and liquid sulphur dioxide, etc.

665.521.5 : 66.061.5 : 608.3

E. R. Birkhimer. U.S.P. 2,026,812, 7.1.36. Solvent extraction of lubricating oil using acetophenone.

665.521.5 : 608.3

B. Y. McCarty and W. E. Skelton. U.S.P. 2,027,346, 7.1.36. Removal of wax from lubricating oils by solvent extraction using a liquid composed of propylene dichloride and one from the groups ethylene glycol monoethyl ether and diethylene glycol monobutyl ether in such proportions that at — 10° the solvent has complete solvent action on the oil and substantially no solvent action on the wax.

665.521.5 : 66.061.5 : 608.3

L. A. Clarke. U.S.P. 2,027,354, 7.1.36. Solvent extraction of lubricating oil using *para*-nitrobenzylalcohol.

665.521.5 : 608.3

E. R. Lederer. U.S.P. 2,027,738, 14.1.36. Production of 0° F. cold-test distillate fraction of a paraffin base lubricating oil from a neutral fraction, normally produced as part of a paraffin-base long residuum in dewaxing at 0° F. A portion of the undewaxed residuum is mixed with the neutral fraction and coolod to — 20° to — 60° F., the wax and diluent are removed, and the neutral and residual fractions separated to provide a 0° F. cold-test distillate.

665.521.5 : 608.3

J. D. Fields. U.S.P. 2,027,770, 14.1.36. Refining of lubricating oils by diluting with a light-petroleum solvent, and then treating it in an anhydrous condition with sodium metal. The oily materials and coagulated impurities are separated, and the petroleum solvent is distilled from the lubricating oil.

665.521.5 : 608.3

W. K. Lewis. U.S.P. 2,028,340, 21.1.36. Vacuum distillation of lubricating oils.

665.521.5 : 66.061.5 : 608.3

J. V. Starr et al. U.S.P. 2,028,361, 21.1.36. Solvent extraction of lubricating oils using phenol or aniline or furfural, etc. W. S. E. C.

Fuel Oil.

662.753.32

444. Lag of Ignition is Utilized to Determine Cetane Rating of Diesel Fuel Oils. P. H. Schweitzer and T. B. Hetzel. *Oil & Gas J.*, 23.1.36, **34** (36), 36.—A practical testing method for determining the cetane number of diesel oil should be convenient, reproducible and representative. The C.C.R. method of Pope and Murdoch is essentially a starting test, and to obtain results accurate to $\pm$ 3 cetane numbers, a painstaking procedure is necessary. The convenience and reproducibility of the delay method are adversely affected by the use of the bouncing-pin as an ignition indicator. In the method developed at Pennsylvania State College the bouncing-pin was replaced by an electromagnetic pick-up. A short stiff wire resting on the diaphragm transmits the motion to the armature of the pick-up. The E.M.F. generated in the coil surrounding the armature is used to control the operation of a thyratron tube. When the velocity of the diaphragm is high, as at the time of ignition, a thyratron relay trips and causes a neon lamp to flash. The timing of the flash is read on a protractor. The mechanism is practically frictionless and is robust. There is but one adjustment, a resistance which determines the minimum rate of rise necessary to trip the relay, and for proper setting this is increased until the neon lamp ceases to flash, when injection is cut out, but responds as soon as ignition takes place. A similar pick-up is used as an injection indicator. The wiring circuit is described and illustrated.

For routine testing the "Fixed Ignition Lag Method" was found most convenient. Injection timing is set and kept at, say, 18° crank angle before T.D.C., and ignition

is always to occur at T.D.C. exactly. The adjustable plug is moved until this condition is reached, and the "required compression ratio" of the fuel under test is read off. In the same manner, the R.C.R. of blends of cetane and α-methylnaphthalene are determined, and a calibration curve is established. Secondary reference fuels can be similarly calibrated, and typical curves are plotted.

The calibration curve varies only little from day to day, and even that variation could possibly be eliminated by keeping the intake air pressure independent of the barometric pressure. The method is claimed to be much faster than either the C.C.R. or the knock meter method, and 7 to 8 fuels can be accurately tested in an hour.

A number of fuels have been tested for physical properties, C.C.R. cetane value, aniline point, diesel index, viscosity–gravity index, viscosity–slope index and cetane value by the fixed ignition lag method. The results are tabulated, and show that the chemical tests do not offer a perfect substitute for engine testing, but may be used for approximate ratings in laboratories not equipped with a fuel-testing engine.

As a result of investigations, the optimum conditions for ascertaining cetane values by the proposed method are: engine speed 900 r.p.m. ± 30 r.p.m.; injection angle advances between 16° and 26° C. do not affect relative ratings of fuels, but 18° is the most suitable; injection tube 0·125 in. bore × 6 in., nozzle opening pressure 1500 lb. per sq. in.; fuel quantity 0·020 ml. per injection; inlet air temperature 100° F. Effects of varying the individual conditions on fuel ratings are discussed. Tolerances permitted are not so wide as to affect fuel ratings, and yet can be maintained easily. Oscillograph measurements indicate that combustion knock follows more the maximum rate of pressure rise than the ignition lag. From the operator's point of view the latter is probably more important. R. A. E.

662.753.32

445. Effect of Crude Source on Diesel Fuel Quality. W. H. Hubner and G. B. Murphy. *Nat. Petr. News*, 22.1.36, **28** (4), 22; 29.1.36, **28** (5), 25.—A survey has been conducted to determine, first, the fuel requirements and recommendations of diesel engine manufacturers, and second, the quality of the fuel available in the U.S.A. The results of a questionnaire with the first object in view are tabulated under sub-headings, arranged according to engine speed. Ignition quality, cleanliness and viscosity appear to be the most important properties, although some manufacturers considered other properties of primary importance. For the second part of the survey, straight-run and cracked fuels from 9 different fields were examined for ignition quality. 50/50 blends of straight-run and cracked fuel, blends of cetane and α-methylnaphthalene, Shell "high-cetane" secondary reference fuel, and blends doped with ethyl nitrate were also examined. Engine tests were carried out by the C.C.R. method, using a modified C.F.R. engine, and by the ignition lag method of Boerlage and Broese on a Thomassen–Delft engine. Other expressions of ignition quality were also determined, viz. diesel index number, viscosity–gravity number, boiling point–gravity number, blending octane number and U.O.P. characterization factor. The diesel index number D.I. $= \frac{GA}{100}$, where G = A.P.I. gravity at 60° F. and A = aniline point. The viscosity–gravity number A is given by the equation: $G = 1{\cdot}082A - 0{\cdot}0887 + (0{\cdot}776 - 0{\cdot}775A)(\log \log (KV - 4))$, where G = sp. gr. at 60° F. and KV = kinematic viscosity in millistokes. Boiling point–gravity number A is given by $G = A + (68 - 0{\cdot}703A) \log B.P.$, where G = A.P.I. gravity and $B.P.$ = 50% distillation point in °C. The U.O.P. characterization factor $K = \frac{(T_b)^{\frac{1}{3}}}{S}$, where S = sp. gr. at 60° F. and T_b = the molal average boiling point in degrees Rankine. Viscosities were determined in the Fitzsimmons suspended-level viscometer. The results show: 1. That, irrespective of the source of the fuel, cetane ratings are higher by the C.C.R. method than by the ignition lag method; 2. For doped fuels, as against undoped fuels, the position is reversed; 3. With the exception of doped fuels and cetane/α-methylnaphthalene blends, a general relationship exists between the results of engine tests, by both methods, and the various other ignition quality factors; 4. Of these factors the blending octane number appears to give the closest correlation with cetane ratings; 5. All four factors correlate equally well, but the U.O.P. characterization factor has the advantage of flexibility in that any two of a number of physical

properties may be used to deduce it from charts which are available; 6. Although the correlation is good, these factors furnish only a guide to ignition quality, and accurate data are forthcoming only from actual engine tests; 7. The results indicate that all the 9 sources from which the fuels under review were taken can supply fuel of satisfactory quality; 8. Cracked fuel always has a lower ignition quality than the straight-run fuel from the same source, but the indications are that a considerable proportion of cracked fuel may be blended without undue loss of quality. H. G.

662.753.32

446. Ignition Characteristics of Diesel Oils. K. Yamazaki and S. Ota. *J. Fuel Soc. Japan*, 1935, **14**, 134–137.—A table is given of the characteristics of seven commercial light oils, one commercial heavy oil and thirteen especially prepared high-speed diesel oils. These characteristics include specific gravity, distillation range, aniline point, diesel index, mean boiling point, dispersion, ignition index, S.U. viscosity and cetene number (calculated). Two of the oils were compared in a high-speed diesel engine. G. R. N.

662.753.32

447. Influence of Paraflow on Pour Point of Diesel Fuel. A. I. Doladugin, M. A. Solodovnik and B. A. Englin. *Neft. Khoz.*, 1935, **28** (4), 68–78.—Compounding high with low viscosity products without any additions does not depress the pour point satisfactorily. A 0·5–1% addition of paraflow to gas oils with low paraffin content lowers their pour point to − 25° C. to − 30° C.; however, the pour point of Grozny petroleum products, beginning with kerosine and down to heavy oils, can be lowered only by compounding and the introduction of paraflow. The removal of aromatic hydrocarbons from asphalt-base petroleum products permits a lowering of the pour point of Grozny mixed-base products when compounding the above oils. The pour point of products containing 2–5% paraffin is not lowered on the addition of paraflow. Low melting point paraffins are more susceptible to paraflow. The medium holding the dissolved paraffins has a great effect on the behaviour of paraflow, oils with high melting point aromatic compounds are least affected by paraflow. The experiments are described. For. Petr. Techn.

662.757

448. Colloidal Fuel. A. B. Manning and R. A. A. Taylor. *Engineer*, 1936, **141**, 229.—A brief account is given of the various uses of colloidal fuels, *i.e.* coal–oil suspensions. Colloidal fuels are the most compact fuels known, in that their potential heat content per unit-volume is a maximum; further, the danger of spontaneous combustion is absent from such mixtures, and since their density is greater than one, fires may be prevented by a shallow water-seal. Apart from these considerations, colloidal fuels present certain other advantages over coal and oil, considered either together or separately. In the course of their remarks the authors discuss the somewhat isolated large-scale tests which have been carried out on this type of fuel, and, in addition, the questions of stability, combustion and scope, and finally the economic aspect. H. E. T.

Wax.

665.521.6

449. Theoretical Principles of Paraffin Sweating. J. Hausman. *Ole, Fette, Wachse*, 1936, **1** (4), 9.—As a method of separating a mixture of solid paraffins, sweating or fractional melting is inferior to fractional crystallization. The melting point of a sweated fraction is always lower than the arithmetic mean melting point of its components. When a paraffin mixture is warmed up, as in sweating, the constituents do not melt individually, but as mixtures which contain hydrocarbons of much higher melting point than the maximum sweating temperature. In fractional crystallization, however, individual hydrocarbons or isomorphous mixtures thereof, separate successively from the melt, in the order of their setting points.

These considerations were supported by experimental results. The following treatment is given for fractionating a scale in order to obtain a maximum yield of

high-melting wax. The molten scale is cooled slowly to a temperature at which maximum crystallization of wax of the desired S.P. occurs. The crystallized wax is filtered off at that temperature, and the filtrate is similarly treated in order to obtain the next grade. P. G. H.

Asphalt and Bitumen.

665.45 : 532.13

450. Viscosity of Road Tars. J. G. Mitchell and A. R. Lee. *J.S.C.I.*, 1935, **54**, 407T–410T.—Viscosity measurements of a number of tars and pitches confirmed that a linear relationship exists between log viscosity and log temperature ° F. This relationship does not hold at temperatures below 10° C., whilst certain low aromatic tars give two straight lines meeting at a slight inclination at temperatures in the region of 30–32° C. The slope of the line is, therefore, a constant which the authors term the log temperature coefficient, and on plotting the latter against log viscosity the points for the majority of the tars fell within a narrow area bounded by two parallel lines. It was found that on altering the viscosity of the tar by distillation *in vacuo*, or by fluxing with oil similar to that in the tar, the point representing the original tar moved in a direction parallel to the boundary lines. This procedure is, therefore, put forward as a method of evaluating the viscosity–temperature characteristics of a tar relative to any other tar, irrespective of viscosity. The viscosity characteristics may be given by the viscosity at 25° C. and log temperature coefficient. For use in the examination of exposed tars a method is given for comparing the change in viscosity resulting from exposure and from loss of oil by distillation, whilst a method for estimating the amount of cutting back required to produce tars of specified viscosity is also described. A. O.

665.45.032.5

451. Paraffinic Bitumen. M. M. Faingar and E. M. Braude. *Neft. Khoz.*, 1935, **23** (3), 67–70.—It was found that bitumens containing up to 2% paraffin and up to 8% ceresin are suitable raw materials for roads and for the preparation of roofing material (from cardboard). For. Petr. Techn.

665.45 : 532.13

452. Rheological Properties of Asphalts. III. A Viscosity Index. R. N. Traxler and H. E. Schweyer. *Physics*, 1936, **7**, 2.—The change of viscosity with temperature is an important characteristic of asphalts, and several functions have been proposed by means of which various asphalts could be compared in this respect. The authors review these functions, and point out that in every case the proposed function is dependent on measurement of penetration or of hardness, softening point, etc. These properties are only loosely related to viscosity, and, for this reason, the authors regard the proposed functions as poor measures of susceptibility.

The viscosity–temperature relation of an asphalt may be represented by the equation: $\log \eta = at + \log b$ when η = viscosity in poises at t° C., and a and b are constants. This equation gives a straight line if $\log \eta$ is plotted against t. It is found that the viscosity–temperature relation for an asphalt may be represented by two such lines, one applying at temperatures below the softening point, and one above.

It is proposed that the temperature susceptibility of an asphalt should be measured by the percentage decrease in viscosity for 1° C. temperature rise over any range for which the above equation applies. It is shown that A.V.I. $= 100(10^a - 1)$, where A.V.I. is the asphalt viscosity index defined as above and a is the constant in the above equation.

Experimental results on 14 asphalts over temperature range 15–35° C. are used to obtain values of the A.V.I. which range from 19·2 to 24·7. P. D.

668.732 : 668.3

453. Patents on Asphalt. J. Y. Johnson. E.P. 442,080, 29.1.36. Manufacture of a binding agent for road surfaces. Residues from the distillation of mineral coal-tar are treated in the presence of a condensing agent, *e.g.* of the Friedel–Craft type, and

heated with a chlorinated aliphatic compound of high molecular weight such as chlorinated montan wax.

665.521.8 : 608.3

U. B. Bray and L. B. Beckwith. U.S.P. 2,029,290, 4.2.36. Production of asphalt by oxidizing asphaltic residual oils and separating the oxidized asphalt into its oil and bitumen constituents by means of solvents.

665.45.094.38 : 608.3

E. G. Ragatz. U.S.P. 2,029,504, 4.2.36. Production of oxidized or air-blown asphalts by mixing the oil with oxygen-containing gas at 450–500° F. The temperature is then increased to 650° F. and the mixture agitated at this temperature and under 25 lb. pressure/sq. inch., to allow oil fractions to polymerize and further asphaltize the oil. The oil fractions are subsequently distilled from the oxidized and polymerized asphalt.

665.737.6 : 608.3

S. P. Miller. U.S.P. 2,030,528, 11.2.36. Production of blended pitch products from coal-tar by distilling the tar to a pitch of melting point above 250° F. and blending while still hot with a flux.

665.521.72 : 608.3

B. L. Rose. U.S.P. 2,028,922, 28.1.36. Manufacture of asphalt by blending an oily distillate cylinder stock (flash point not below 550° F.), a non-cracking distillation residue free from lubricating oil and having a flash point of 650° F. and a residue from a cracking operation, and then oxidizing. W. S. E. C.

Special Products.

547.223

454. Organic Inhibitors of Corrosion. Aliphatic Amines. C. A. Mann, B. E. Lauer and C. T. Hultin. *Ind. Eng. Chem.*, 1936, **28**, 159.—The effect of aliphatic amine inhibitors on metal surfaces is to cause a protective layer to form by adsorption of inhibitor ions on the surface and through the nitrogen atom.

Corrosion tests were made in normal sulphuric acid on very small sheets of mild steel of known composition. The sample was made smooth, but not given a high polish, and carefully cleaned and dried. The surface area was determined by means of micrometer calipers, and the sample was then weighed. After the conclusion of the test, the sample was rubbed with a soft brush, rinsed in boiling water, dried and again weighed. The rate of corrosion was reported as loss in gms./sq. cm./hr.

The results showed that long straight-chain aliphatic diamines and triamines were very good acid-corrosion inhibitors. The longer the hydrocarbon chains and the greater the number up to three attached to the nitrogen, the greater was the effectiveness of the inhibitor and less of the inhibitor was required. W. S. E. C.

620.197

455. Corrosion in Stored Engines Prevented by New Flushing Compound. Anon. *Nat. Petr. News*, 1.1.36, **28** (1), 24.—An anti-rusting composition prepared according to the following formula is claimed to be very efficient: triethanolamine 5–6%, aluminium stearate 10%, butanol 10–12%, lard oil—to 100%. The composition is a clear brown liquid with a viscosity of 550 secs. at 150° F. It is best applied by means of a specially designed spray gun, but may also be placed in the crankcase and distributed by turning the engine. It forms a viscous, jelly-like film which resists flow and clings tenaciously and uniformly to the metal surfaces. It is claimed to be particularly useful in combating the "cold corrosion" prevalent in humid tropical climates. H. G.

665.345.4

456. Studies in the Drying Oils. XIX. Oxidation of Linseed Oil. R. S. Taylor and J. G. Smull. *Ind. Eng. Chem.*, 1936, **28**, 193.—Alkali-refined linseed oil was oxidized by bubbling air through the oil in glass percolators, and the temperature regulated by an electrical resistance enclosed in glass and immersed in the oil. The following tests

were applied to the oil before and after oxidation : refractive index, heat of combustion, iodine number, and ultimate analysis. The reaction involving maleic anhydride and conjugated compounds (Diels and Alder reaction) was applied to the oil in various degrees of oxidation. It was found that the point at which the oil began to exhibit reactivity with maleic anhydride was coincident with the point at which the index of refraction and the heat of combustion were changing rapidly. A series of determinations of acetyl values showed that maleic anhydride did not react with the hydroxyl groups. W. S. E. C.

665.547

457. Sulphur Dioxide and Fresh Sulphuric Acid from Refinery Acid Sludge. B. A. Stagner. *Ind. Eng. Chem.*, 1936, **28**, 171.—The paper describes a detailed investigation into the effect of thermal decomposition (540° F.) of sulphuric acid sludges produced by conventional refining of gasoline, naphtha and lubricating oils from California stocks.

A "sulphur balance" is given, showing that about 93% of the sulphur present in the refining acid may be recovered usefully as SO_2 : the sulphur not recovered as SO_4 remaining in combination with the coke which is neutral and easily pulverized. The other products of the process are : (1) coke, varying from about 20% of the sludge in the case of gasoline refining to about 50% for lubricating-oil sludges ; (2) oil, which varies from about 10% to 1% of the sludge, and (3) water in amounts from 10% to 25% by weight on the acid sludge.

In the commercial process the sludge is fed continuously into a rotating kiln heated to about 540° F. in direct contact with hot combustion gases or with coke derived from the acid sludge. A mixture of sludges is recommended as lubricating-oil sludge alone gives a non-pulverizable coke. The liberated SO_2 is reconverted into fresh sulphuric acid in a contact plant.

The acid content of the refinery sludges examined was measured by direct titration and varied from 40% to 60% H_2SO_4 for gasoline and kerosine sludges to 25% to 45% for lubricating-oil sludges. F. E. A. T.

665.547.83

458. Naphthenate Driers. M. D. Curwen. *Paint Manufacture*, 1936, **6**, 38–41.—The bulk of the naphthenic acids on the market at present originate from Rumanian and Russian oils, although it is likely that acids from American crudes will soon appear.

They are carboxylic acids of general formula $C_nH_{2n-2}O_2$, the commercial product being a mixture of several acids. The typical commercial substance is light brown in colour, sp. gr. 0·98 and acid value 250.

In the manufacture of driers the acid is neutralized with caustic soda solution, and the metal salt in water solution added until no further precipitate of the insoluble naphthenate is formed. The drier is washed free from adhering salt and either air-dried or heat-dried.

They are sold in several forms : (*a*) as a solid with maximum metal content, (*b*) as concentrated solution or dispersion in linseed oil, (*c*) as concentrated dispersion in an organic solvent, (*d*) as a paste.

A good drier should have the following properties :—

1. High available metal content, and consequent high drying power. The less the proportion of drier added to an oil, the better the final film, so that driers with the highest available metal content can be used in smaller quantities.

2. Stability. Oxygen attacks linoleate and resinate driers, but has much less action on naphthenates.

3. High solubility or ease of dispersion.

These driers are soluble in most organic solvents and in linseed oil. Having low melting points, they go into solution in linseed oil without excessive heating.

4. Neutrality.

5. No deleterious effect on final film.

Since a smaller quantity of these driers is necessary than in the case of other driers, there is less tendency for harmful effects to occur.

There is reason to believe that the organic portion of the drier molecule plays an important part in its activity.

A description is given of the general properties of the commercial naphthenates available. D. L. S.

667.634

459. **Reaction Between Paint Films and Zinc Surfaces.** H. J. Wing. *Ind. Eng. Chem.*, 1936, **28**, 242.—The failure of paints of the oil or oil–resin type to adhere properly to zinc or galvanized surfaces has been studied. It was observed that very thin layers of white material adhered to the paint film. These consisted of zinc formate, and were not formed on plain iron surfaces containing no zinc. W. S. E. C.

666.931.1

460. **New Uses for Spent Fullers Earth.** H. L. Kauffman. *Nat. Petr. News*, 25.12.35, **27** (52), 25; 1.1.36, **28** (1), 21.—The addition of spent granular fullers earth to gypsum-type plastering compositions in the place of plastering sand is claimed to have many advantages. Although it is claimed that any spent fullers earth or discolorizing clay has its use in this or similar connections, spent 30–60 refiners' clay is preferred. Data published show that setting times are reduced 10 to 20 times, according to the proportion of spent earth used. Increasing this proportion decreases the setting time. Spent earth has a bulk specific gravity approximately half that of plasterers' sand, and on a weight basis the covering capacity of plasters incorporating the former is greatly increased over those containing sand. Strength after setting is not greatly impaired. Greatly increased resistance to moisture after setting is claimed. Ready prepared mixtures of plaster and sand are stated to be unsatisfactory owing to their pronounced tendency to absorb moisture, and therefore harden in storage. Ready mixed spent earth/plaster compositions are stated to have been successfully stored for 6 months. The high porosity and lower bulk gravity of these plasters make them capable of classification as semi-acoustic plasters. Added to ordinary portland cement concrete mixes in place of 15% of the sand, the spent earth produces a slight increase in crushing strength. 40% of spent earth appears to be the maximum amount which may be used without seriously impairing the strength of the cured concrete. When used in the preparation of bricks by the "dry mix" process, the bricks are almost completely waterproof. Other uses indicated are as filler in bituminous mastics, cheap paint, etc., as the base in insecticides and fumigating powders, and a diluent for vitamine preparations for poultry. If the spent earth is roasted and ground, it may be used for water purification, as the base in pigments, for the preparation of insulating compositions, as the base for catalysts, etc. H. G.

675.025

461. **Oils for Currying Leather.** Anon. *Chem. Trade J.*, 24.1.36, **98**, 63.—M. P. Balfe, of the British Leather Manufacturers' Research Association, states that one of the most important aspects of the chemistry of oils used in the leather trade is the relation between chemical constitution and tendency to spue. Mineral oils cannot spue because they contain very few unsaturated linkages, and so do not oxidize to a gum in the leather. On the other hand, their non-polar nature makes them slow in spreading over the fine surfaces of the inner fibrils of leather. Working with fish oils, Stather has found that although spue is formed by oxidation of the unsaturated acids in the oil, there is no relation between iodine value and ether-insoluble hexabromide value and tendency to spue. It was found that spue occurs most readily with oils of low free fatty acid content, and does not occur with oils which contain comparatively large amounts of free fatty acids. This probably explains why coast cod oils spue more frequently than Newfoundland oils. R. A. E.

678.77

462. **Duprene Synthetic Rubber Substitute.** Anon. *Engineering*, 1936, **141**, 258.—Special claims are made for a synthetic material consisting of chlorinated butadiene. It is not polymerized by heat, and oxidation is much slower than with natural rubbers. It is also stated to be less permeable to gases and to be resistant to acids and alkalis. It withstands the action of petroleum hydrocarbons better than the natural product. Suggested uses include cable covering, gaskets, washers, packings, for pistons and cups in oil-slush pumps, as a liner for hose conveying oils, etc. C. C.

621.892.096.1 : 608.3

463. Patents on Special Products. A. Eichengrün. E.P. 441,266, 14.1.36. Anti-freezing agent, more particularly for use in motor vehicles, consisting of a solution of a mixture of alkali or alkaline-earth metal nitrite which is substantially stable under conditions of use, with 3–5% of an anti-corrosive agent, *e.g.* carbonates or phosphates of alkali or alkaline-earth metals.

665·52 : 66.062.2 : 608.3

Bat. Petr. Maat. E.P. 441,806, 27.1.36. Production of valuable products from mineral oils, *e.g.* kerosene, gas oil, lubricating oils and solid resinous products applicable in the varnish and lacquer industries, by treating the oils containing aromatic hydrocarbons with acetylene hydrocarbons or gas mixtures in the presence of aluminium chloride.

663.551.42 : 608.3

Standard Oil Co. (California) and L. Mellersh-Jackson. E.P. 442,051, 31.1.36. A process is described for dehydrating alcohols and ketones by means of a volatile liquid such as petroleum ether which is immiscible with water and miscible in a large proportion with the alcohol or ketone of the mixture.

547.313 : 542.1 : 608.3

Bat. Petr. Maatsch. E.P. 442,454, 10.2.36. Production of esters from olefines or olefine mixtures. Carboxylic acids are heated with excess of an olefine mixture containing organic compounds capable of acting as carriers or solvents for part of the esters formed in the presence of a condensation catalyst, *e.g.* sulphuric acid. The mixture is allowed to stratify, and the esters are recovered from the solvent phase.

679.582 : 608.3

U. B. Bray. U.S.P. 2,029,288, 4.2.36. Production of plastic resins from petroleum by distilling cracked residuum to a pitch (of m. p. 300° F.), and distilling the pitch to isolate a resin of sp. gr. 1·084–1·126, m. p. 93–150° F. and ductility over 100 cms. at 77° F. The cracked residue is separated into fractions by means of a solvent having a low solvent power for asphaltic substances. The asphalt is removed and the dissolved cracked residuum fractions are extracted with a selective solvent having a selective action on aromatic constituents. The aromatic fractions dissolved in the solvent are removed and distilled to obtain the resin of the given properties.

66.061.8 : 608.3

G. A. Mott and C. C. Jones. U.S.P. 2,032,299, 25.2.36. Device for recovering solvent from the sludge formed in settling tanks of cleaners' vats. W. S. E. C.

Engines.

621.434

464. High Compression Combustion Aided by Composite Cylinder Heads. Anon. *Nat. Petr. News*, 11.12.35, **27** (50), 52.—It is claimed that the "pinking" that occurs at the higher compression ratios has been eliminated in an engine in which a copper inset has been fitted into the combustion head. The inset faces the piston, and its function is to cool the gases which are last to burn—that is, those farthest from the plug. The inset is fitted with fins projecting into the water cooling-chamber. The surface area of the fins is three times that of the surface exposed in the combustion head. H. G.

621.436

465. Tests on 250 H.P. "Brush" Airless-Injection Engine. Anon. *Engineering*, 1936, **141**, 101–102.—An account of an independent series of tests on a four-cylinder horizontally opposed engine similar to those recently installed in the *New Zealand Star* for compressor drives. One set of tests was made at constant speed with varying loads from light to 10% overload. The fuel consumption varied progressively between 0·524 lb. per B.H.P./Hr. at 25% load and 0·357 lb. per B.H.P./Hr. at full load, whilst the figure for 1-hour run at 10% overload was 0·363. Very satisfactory figures were

also obtained at varying speeds with full-load torque varying between 0·394 and 0·356 lb. per B.H.P./Hr. at speeds from 125 to 250 r.p.m. C. H. S.

621.436

466. Running Test of a Diesel Motor, Type "D.1," Constructed in the Hispano-Argentina Works. E. H. Arce. *Bol. Inform. Petroleras* (*B.A.*), Dec. 1935, **12** (136), 49–62.—This is a four-cylinder motor, diam. 108 mm., stroke 146 mm., which develops a maximum of 75 H.P. at 2000 r.p.m.

The article is illustrated by 4 photographs, 5 sectional drawings and 1 graph.

The test gave the following results :—

40 hours at	1250 r.p.m.	developing	35·33 H.P.	= 1413·20	H.P.-Hours
23 ,,	,, 1350	,,	,,	44·58	,,	= 1025·34	,,
137 ,,	,, 1450	,,	,,	55·08	,,	= 7546·96	,,
			Total			9985·50	,,

The total consumption of combustible was 1480 kgs., or 0·149 kg. per H.P.-hour, and of the lubricating oil 10·5 kg., or 0·001 kg. per H.P.-hour, over 200 hours of continuous running. L. O.

General.

622.323 : 622(4/9) 665.5 : 66(4/9)

467. Some Aspects of the International Petroleum Policy. E. Leupold. *Bol. Inform. Petroleras* (*B.A.*), Dec. 1935, **12** (136), 17–45.—1. *The United States of North America.* U.S.A. production may be divided into 3 periods : 1857–1900, 1901–1919 and 1920–1934. These are tabulated, and the corresponding Argentine figures are included for comparison.

Years.	Total Production. cu. m.	Total Wells Drilled.	Dry Wells.	% Dry Wells.	Producing Wells.	Production per Well in cu. m.	
						Drilled.	Producer.
1857–1900	160,124,448	173,045	32,000	18·5	141,045	925	1,135
1901–1919	642,624,258	349,586	71,176	20·4	278,410	1,838	2,308
1920–1934	1,853,732,028	302,504	87,919	29·07	214,585	6,128	8,639
1857–1934	2,656,480,734	825,135	191,095	23·16	634,040	3,219	4,190
Argentine Production							
1907–1934	19,530,764	3,758	447	11·89	3,311	5,197	5,898

The three-fold increase of production for 1920–1934 over 1901–1919, in spite of a reduction of 13·4% in the number of wells drilled, is notable. Another interesting feature is the upward trend in the percentage of dry holes. This indicates the increasing difficulty of discovering new oil horizons, even with the perfected scientific methods now employed. On the other hand, average production per well drilled has increased from 925 cu. m. (1857–1900) to 6128 cu. m. (1920–1934), this augmentation reflecting improved production technique. Costs per well have increased from $5175 (1857–1900) to $42,180 (1920–1934), but this is largely the result of deeper drilling.

It will be noted that the modest Argentine figures compare very favourably with those of U.S.A. as regards the percentage of dry holes and the average productivity of wells.

The oil reserves of the United States have been variously estimated as being from 40 years' supply down to 10. The total production of U.S.A. to the end of 1934 has amounted to 2,656,000,000 cu. m. ; or about two-thirds of the world production. To meet current demands, and to maintain a reasonable reserve, the discovery of new sources of oil amounting to 1,000,000,000 barrels is necessary each year. This represents the drilling of 20,000 wells per annum.

Since the Great War, the U.S. oil industry has been the object of repeated study and investigation by the Federal Government, which, fully realizing the incalculable importance of oil in peace and war, and the fact that it is limited in quantity and irreplaceable, has taken severe measures against avoidable waste.

The first of these measures were administrative, and were directed against the existence of monopolies (*e.g.* the Sherman Law of 1911).

Presidents Coolidge, Hoover and Roosevelt have all realized the necessity for a large measure of State regulation in the industry, and during the last 20 years 11 official estimates of the petroleum reserves of the U.S.A. have been published, the latest of which places the amount at 12,177,000,000 barrels. This figure includes all recently discovered fields.

At the time when the oil business commenced to be one of the most promising in the U.S.A., the big companies (soon to attain an economic might exceeding that of any other industrial or financial power in the world) thought fit to predict that the U.S.A. oil resources were practically inexhaustible, and that exploitation by small operators would lead to an over-production so great as to bring ruin to the small landholder, who owned the mineral rights, and to the nation. In spite of this discouraging campaign, an orgy of drilling set in, and the big companies changed their tactics.

The small producer, dangerous because of his numbers, had to be muzzled through the control of transport. Ownership of the pipe-lines by the big companies thus enabled them to enslave both the independent producer and the "outside" refiner. Refineries, however, soon sprang up as if by magic, to such an extent that their capacity (on January 1st, 1935) exceeded the production of crude petroleum by 50%.

Another change in tactics thus became necessary, and the big companies commenced to buy up, at any price, the patents dealing with oil, particularly refining. A monopoly of high octane-value gasoline has thus been secured by the big oil interests.

The latest newspaper campaign has been waged with the object of convincing the public of the necessity of importing foreign crude in order to conserve the domestic supply. This follows the collapse of compulsory proration dictated by the N.I.R.A. Some measure of success has already been achieved, for the importation of bunker oil will no longer be considered as importation of oil for domestic use. The big interests thus obtain a monopoly of the sale of oil for marine purposes. They produce this oil in foreign fields, without the severe restrictions which cripple the small producers in U.S.A.

The depletion of U.S. potential reserves of oil, the increasing cost of drilling, legal restrictions on production, and the socialistic visions of Mr. Roosevelt have now created a situation so definite that the staffs of the international oil trust have been considering, for some time past and with increasing preoccupation, an adaptation of their defensive tactics to meet this combination of circumstances.

A list showing the world-wide interests of the Standard Oil Co. of New Jersey (taken from the *Petroleum Times*) is included. It is pointed out that U.S.A. in 1935, produced 62·5% of the world's petroleum; Russia, 10·23%; and the rest of the world, 27·27%. Of this 27·27%, Standard Oil, Dutch Shell, Anglo-Iranian and subsidiaries produce 22·72%, and the production by all independents amounts to only 4·55% of the world's supply.

2. *Russia.* At the forthcoming International Geological Congress, to be held in Moscow in 1937, it is proposed to bring forward data to prove that the Russian reserves of petroleum are the largest in the world. Gubkin places these at 21,000,000,000 bri. Of this quantity, half is considered to be immediately available, and is classified as occurring in explored deposits, deposits "in sight," presumed deposits and possible deposits. The other half is allocated to the same strata existing at a depth at the moment too great to be reached with the present drilling technique.

In 1934, Russia produced 11% of the world's oil, the increase in production during the 12 years 1920–1931 being 515%. The years 1932–1933 showed a fall of 4·2%, but this has been recovered by the increase of 7·8% in 1934. This figure of 1934 represents an all-time peak, but it is only 57% of that required by the modified Five-Year Plan.

Actually, the production situation is still deplorable. In the first six months of 1935, 1000 of the 4400 wells in production in the Baku district were shut down through accidents, and 2000 were not producing, for various reasons. Waste is considerable: the conservation of natural gas is still practically unknown in Baku, and 60,000 tons of gasoline are lost annually owing to this fact. In the first five months of 1935,

400,000 tons of gasoline were lost by evaporation in transit from well to refinery, the product of the refineries being 316,000 tons over the same period.

In spite of new constructions, the majority of the ancient retorts of the Baku refineries are in a ruinous state. Some of them, 60 years in use, recover only 17% of light products from crude oil containing 39%.

Millions upon millions of roubles have been wasted on drilling in geologically unfavourable zones or on faulty geophysical data obtained with instruments of Russian manufacture.

Unfavourable conditions of production and refining have produced a considerable shrinkage in Russian exports. At the end of 1932, the Soviet abandoned its policy of aggressive conquest of new markets and its systematic sabotage of prices and conditions of sale. This change of policy, however, is not solely responsible for the shrinkage of exports. There are four other factors: (1) increased domestic consumption; (2) out-of-date refinery technique; (3) the necessity of obtaining the full market price in order to buy new derricks and retorts; and (4) political difficulties.

3. *Venezuela.* In view of the rapid diminution of U.S.A. reserves, the international groups have used every means to secure priority in oil regions which offer prospects of perpetuating their present economic-financial power.

Venezuela is the largest oil producer in South America, and third in the world. Since this country gave concessions to the Royal Dutch Shell and the British Controlled Oilfields—which concessions are still in force—its legislature has passed a law prohibiting the granting of mining rights to foreign states, to the nominees of foreign states, or to companies not constituted in Venezuela. This law has had the effect of placing any new development of the Venezuelan oil industry exclusively in American hands.

Standard Oil subsidiaries are responsible for 50% of the Venezuelan production. In the first half of 1935, they acquired 1,650,000 hectareas of prospective oil-lands.

Although Venezuelan production is 10 times greater than that of the Argentine, the capacity of the Venezuelan domestic refineries is 3 times less. This is due to the fact that the refineries of the Venezuelan companies, for political and economic reasons, are not on Venezuelan soil, but just outside its boundaries at Aruba and Curaçao.

4. *Abyssinia.* An account of the Rickett concession is given, together with the statements of certain officials of the Standard Socony Vacuum, and comments from sections of the U.S. press.

5. *Argentina.* The law 12,161, which reserves the right of petroleum exploitation in the Argentine to domestic companies, is defended. It is pointed out that any special consideration is not to be looked for, by Argentina, from the international oil interests. Mexico, and even England, have now adopted similar measures to protect the national interests in domestic oil-production.

For the international trust, Argentina does not represent more than the most insignificant part of its business, but, for the Argentines, it is the Fatherland.

L. O.

665.5 : 66(45)

468. The New Petroleum Policy of the Italian Government. A. Asquini. *Bol. Inform. Petroleras* (*B.A.*), Dec. 1935, **12** (136), 97–101.—In accordance with the 1933 statistics, the annual petroleum requirements of Italy are: gasoline, 451,000 m. tons; kerosene, 179,000 m. tons; gas and fuel oils, 901,000 m. tons; and lubricating oils, 83,000 m. tons.

The Italian consumption of gasoline has doubled since the Great War, and a corresponding increase is expected during the next decade, as the gasoline consumption, per capita, in Italy is only 14·6 litres per annum, as compared to 30 for Germany, 73 for France and 106 for England.

The policy of the Fascist Government may be summarized: (1) the full development of the existing national resources, securing, at least in part, autonomous foreign supplies; (2) the creation of an autonomous domestic petroleum industry, with provision of reserves adequate to the demand; and (3) the regulation of sales.

All mineral deposits have been under State control since 1927, and the production of crude petroleum from domestic sources amounted to 26,227 m. tons in 1933. Preparations have been made for the production of petroleum products by distillation of asphalts, bitumens, and lignites, but the experimental stage is not yet passed. Abroad, through the agency of the semi-official "A.I.P.A." and "A.G.I.P.," Italy has secured

control of sources of crude petroleum in Albania, Rumania and Iraq. The total amount of light petroleum products refined annually in Italy has now reached 150,000 m. tons, which is about a third of the national requirement. Law No. 17,741 of November 2nd, 1933, has for its object the development of domestic refining to meet practically the whole of the internal demands, together with the provision of adequate storage for the crude oil and refined products sufficient for national defence.

L. O.

665.5 : 68(46)

469. Production of Liquid Combustibles and Lubricants in Spain. *Bol. Inform. Petroleras* (*B.A.*), Dec. 1935, **12** (136), 102–108.—Coal, lignite and bituminous shales are abundant in Spain, and a commission, created by an Order, dated July 11th, 1934, is studying the means by which these national assets can be utilized to supply, in part at least, the national petroleum requirements.

All nationally produced light hydrocarbons will be marketed by the Compañía Arrendataria del Monopolio de Petróleos, S.A. (C.A.M.P.S.A.). Particulars of the allowable maximum and minimum capacities of the refineries, and of the maximum and minimum prices for light hydrocarbons, according to the nature of the prime material treated, are given.

L. O.

REVIEWS AND BOOKS RECEIVED.

Reviews.

665.5 : 66(73)

AMERICAN PETROLEUM INDUSTRY. A Report by the Executive Committee of the American Petroleum Institute. Pp. xiv + 229. 1936, American Petroleum Institute, 50 West 50th Street, New York. Cloth $1.00. Paper 50 cts.

THE petroleum industry of the United States ranks first among the mineral industries of that country, on the basis of the value of products. The industry gives direct employment to one million persons. Its invested capital is estimated at £2,400,000,000. It produced in 1935 approximately 135,000,000 tons of petroleum. Its purchases of materials and supplies are estimated at £175,000,000 per annum.

The interests of this great industry are admirably served by the American Petroleum Institute. The statistical and economic surveys prepared by the A.P.I. are no less important than its contributions to technical advancement, standardization and safety work. In 1925 the Institute published *American Petroleum; Supply and Demand*, a comprehensive economic review of the industry at that time. This survey of 1925 has now been brought up to date by the Executive Committee, and a completely new volume is the worthy result of their work. In their survey of every aspect of the industry in turn, the Executive Committee had the assistance of numerous expert sub-committees. Not only are the economic facts of the American petroleum industry clearly set out for the benefit of the American public, but petroleum technologists of every country are provided with an authoritative statistical presentation of the changing trends of technical processes which are occurring in the United States.

The calculation of demand over the next 25 years is based on the assumption that the dominating factor in the internal petroleum situation will be an increasing demand for gasoline. Starting from the average of five estimates of the probable future population of the United States, by a series of carefully worked out intermediate stages, the probable demand for motor fuel is calculated for each quinquennial period from 1935 to 1960. From these figures the crude oil required to meet the demand for motor fuel is calculated. It is considered that the yield of gasoline from crude oil, by the increase in the proportion of cracked gasoline, will grow from 43·8% in 1935 to 58·0% in 1960. Meanwhile, the proportionate yield of products other than gasoline will diminish. It is estimated that the peak of demand will occur in 1950.

Then follows an extremely well-balanced review of the problems of the future petroleum reserves of the United States, prepared by a Committee which included the present and past presidents of the American Association of Petroleum Geologists. The view is taken that the reserves will be sufficient to equate the demand previously calculated, without any introduction of substitute fuels from coal and oil shale.

> "The production of motor fuels in quantity in the United States from sources other than petroleums awaits upon necessity rather than invention."

The chapter on Refining occupies about one-third of the book. It is a rich mine of statistical illustration of the economic effects of changes in technical methods. The functions of the refining industry are conceived as the conservation of the nation's crude oil supply, through reduction in operating losses, flexibility of operations increasing the range of products and the continuous improvement of quality. The data which substantiate this claim are as varied in their interest as they are reliable in their documentation. Selecting at random from the various Tables, the reader can obtain data on such widely varying subjects as the consumption of lubricating oils by aircraft, the heat requirements to refine a barrel of oil averaged over the whole industry, the number of oil-burning locomotives in commission, the utilization of liquefied propane, butane and mixed gases, and the number and consumption data of domestic heating installations.

The chapters on Pipe-line Transportation and Taxation are more political in character and domestic in application. Yet the student of the problems of taxation and petroleum legislation in various countries will welcome this presentation of America's peculiar difficulties. Chapters are also included on Marketing and Employment Conditions in the petroleum industry. The book is concluded by a most efficient Index.

S. J. ASTBURY.

553.94 : 54

ELEMENTS OF THE CHEMISTRY AND CLASSIFICATION OF COALS. D. J. W. Kreulen. (Grundzüge der Chemie und Systematik der Kohlen.) 179 pp., 60 figs. and 38 tables. Amsterdam, D. B. Centen's Uitgevers My. N.V., 1935. H.fl. 4.60.

Investigations into the chemistry of coal, its constitution, and its behaviour under the various conditions of its utilization have produced during the last 20 years a vast and fruitful crop of literature, and any attempt to present a summary which pictures the present conceptions in concise form must be welcomed. Mr. Kreulen has succeeded in sketching the substance of the outstanding researches in this field in readable form. Disclaiming completeness, he explains in the preface that much important work had to be omitted to allow him to give a succinct narrative of the most typical and instructive examples of original investigations. The seventeen chapters deal with the classification and formation of coal, the significance of humic acid and humins (ulmins), the factors determining coalification, the composition of coal seams and the properties of coal components, spontaneous combustion and coking properties, the methods of extraction with solvents and the examination of the extracts.

A certain bias in attaching weight to the importance of the humin constituents of coal is observed throughout. In explanation, it should be stated that the author regards the book as a profession of faith in his conception of their relation to a number of properties as expressed in his humic acid curve. As most of his work on this subject has been published in the Dutch language, he now appeals to a wider circle of fellow-workers and possibly critics.

A chapter on Tandjoeng-Enim coal from South Sumatra illustrates the author's scheme of examination by his own and other methods for the characterization of a coal.

The book, printed in Holland in the German language, is well produced and illustrated, and bears the stamp of a practical worker and serious thinker in the field of the chemistry of coal. R. LESSING.

621.791.5(02)

PROCEDURE HANDBOOK OF ARC WELDING—DESIGN AND PRACTICE. 586 pp. 3rd Edn. 1935. Lincoln Electric Co., Welwyn Garden City, Herts, and Cleveland, Ohio. 8s. ($1.50).

The third edition of this book, which is published by the Lincoln Electric Company of Cleveland, Ohio, U.S.A., follows the same general arrangement as the original edition in 1933, but with a number of additional sections of information.

The handbook forms a comprehensive compendium of information regarding electric welding, with particular reference to the shielded arc process, the handbook running to nearly 600 pages.

The only section in which the products of the Lincoln Electric Co. are directly referred to is in a small advertising section at the end of the book, and the publishers are to be congratulated on having provided a great deal of information of a general character calculated to promote the efficient utilization of electric arc welding.

After a brief reference to the forge, thermit, resistance and gas welding processes, the principles of shielded electric arc welding are described in some detail.

The technique of welding is dealt with, and a comparison given between the use of welds and rivets for joints in steelwork.

Methods of avoiding distortion troubles and of stress relieving receive detailed consideration, and also the methods commonly employed for the inspection of welds. A valuable part of the early portion of the book provides detailed figures of speeds and costs, the values being clearly set out in the form of graphs, and also by the aid of diagrams with tables of electrode size, current, actual welding speed and lb. of electrode/foot of weld, tabulated below the relevant diagrams.

Automatic welding with carbon arc is described, and figures of speeds and costs are given.

The structure and properties of weld metal and the weldability of various metals are considered; mild steel; high tensile, alloy and cast steel; forgings, and various metals and alloys and hard facings being covered.

The foregoing detailed information takes up approximately one-third of the book;

the remainder is concerned with designing of machinery, structures, and applications of welding in manufacturing, construction and maintenance.

These three sections provide a useful guide to the basic principles on which arc-welded machines and structures should be designed, and attention is directed to the essential differences between structures and machines designed for riveting as compared with welding. Typical examples of welded designs are provided.

In the various applications of arc welding in manufacturing, construction work and maintenance, a wide range of illustrations of large bridges, jetties, river craft and ocean-going vessels, multiple-storey buildings, pumps, constructional equipment, such as power shovels and drag line buckets, machine tools and refinery equipment such as tanks, fractionating columns, pressure vessels and pipe ranges, are given.

A. C. VIVIAN.

Books Received.

536.46

FLAME. O. C. de C. Ellis and W. A. Kirkby. vi + 106 pp. 1936, Methuen & Co., London. 2*s*. 6*d*.

This book is one of the series of Monographs on chemical subjects, and offers an analytical scrutiny of the conditions of ignition of a flame that spreads through a prepared mixture of mutually reactive gases, and its propagation thereafter. Combustion is examined from the aerodynamical, chemical and physical aspects.

Imperial Institute:

351.823.3

MINING ROYALTIES AND RENTS IN THE BRITISH EMPIRE. 183 pp. 1936, Imperial Institute, London. 3*s*. 6*d*.

Following an introduction dealing briefly with royalty systems in general, the main subject matter is divided into two parts. In Part I the statement for each country opens with a summary as regards the ownership and right to work minerals, followed by details of royalties and export duties leviable on minerals and metals, with information regarding terms and rents of mining leases.

In Part II the royalties and duties detailed in Part I are summarized for reference purposes, under eight groups, *i.e.* coal; petroleum and natural gas; bituminous and oil shales; ores of iron and of the ferro-alloy metals; base metals; precious metals; precious stones; and miscellaneous minerals.

Institution of Mechanical Engineers:

677.72

PROCEEDINGS. Vol. 130. April–October, 1930. xi + 571 pp.

Included in the papers published in this volume is the Fifth Report of the Wire Ropes Research Committee, which occupies 106 pages, and has a bibliography of 139 references to wire ropes.

U.S. Bureau of Mines:

665.521.6

BULL. 388. MANUFACTURE OF PARAFFIN WAX FROM PETROLEUM. Ralph H. Espach. 113 pp., 37 figs. 1935, Superintendent of Documents, Washington, D.C. 15 cents.

Details are given of the manufacturing processes employed and the equipment used in the production of paraffin wax from wax-bearing crude petroleum. The information is based on data collected from 30 refineries in the United States.

661.76 : 31

CARBON BLACK. G. R. Hopkins and H. Backus. 10 pp. 1935, Superintendent of Documents, Washington, D.C. 5 cents.

Detailed statistics of the carbon-black industry in the United States for 1934 are given. The total production of carbon black in 1934 was 328,828,000 lb., of which

293,546,000 lb. was obtained by the channel process. Compared with 1933 the production showed an increase of 55,703,000 lb. The total quantity sold during 1934 amounted to 312,612,000 lb., a decrease of 61,856,000 lb. on the 1933 figure, although the average price per pound increased from 2·78 to 3·54 cents.

665.1

INFLUENCE OF PETROLEUM TECHNOLOGY UPON COMPOSITE INTEREST IN OIL. H. C. Fowler and R. A. Cattell. 24 pp. 1935, Superintendent of Documents, Washington, D.C. 5 cents.

What appear to be important effects of outstanding technical developments upon existing thought regarding oil and their influence upon the public interest in oil are analysed. It is indicated that ordinarily the limitations or possibilities of any given programme are measured in the long run by the feasibility of its technical procedure.

661.9

MISCELLANEOUS COMMERCIAL GASES. Frank L. Hess and M. E. Winslow. 23 pp. 1935, Superintendent of Documents, Washington, D.C. 5 cents.

A brief résumé is given of some of the commercial phases of various gases, including liquid air and oxygen, nitrogen, argon, carbon dioxide, hydrogen, neon, krypton and xenon, sulphur dioxide and chlorine.

622.324.5 : 31

NATURAL GAS. G. R. Hopkins and H. Backus. 15 pp. 1935, Superintendent of Documents, Washington, D.C. 5 cents.

Statistics of the production and consumption of natural gas in the United States during 1934 are given. The quantity produced in 1934 amounted to 1,770,721 million cu. ft., an increase of 215,247 million cu. ft. over 1933, while the consumption increased by 211,589 million cu. ft. to 1,764,988 million cu. ft.

662.75

USES OF PETROLEUM FUELS. A. J. Kraemer. 12 pp. 1935, Superintendent of Documents, Washington, D.C. 5 cents.

The extent of the consumption of various types of petroleum fuels, the purposes for which they are used, and their advantages or limitations for various uses are summarized.

ABSTRACTS.

	PAGE
Geology	178 A
Geophysics	186 A
Drilling	189 A
Production	193 A
Pipe-Lines...	196 A
Transport	198 A
Storage	198 A
Gas	199 A
Crude Petroleum	199 A
Physical Chemistry	200 A
Chemistry of Petroleum	202 A
Analysis and Testing	204 A
Refining and Refinery Plant ...	205 A
Cracking	209 A
Hydrogenation	210 A
Polymerization	210 A
Motor Fuels	211 A
Lubricants	214 A
Asphalt and Bitumen	218 A
Special Products	221 A
Engines and Engine Testing ...	223 A
Economics and Statistics ...	225 A
Book Reviews and Books Received	228 A

AUTHOR INDEX.

The numbers refer to the Abstract Number.

Adamyan, L. K., 563
Aktiebolaget Separator-Nobel, 568
Albright, J. C., 504, 575
Aleksandrov, L., 564
Allen, A., 523
Amery, G., 607
Anderson, D. Q., 471
Anderson, J. A., 588
Annable, W. G., 539
Archibald, F. M., 588
Arnold, C., 588
Aruntunoff, A., 507

Begirov, K. N., 567
Bataafsche Petroleum Mij., 603
Batcher, R. R., 606
Beale, C. O., 604
Beardsley, W. H., 588
Beatty, H. A., 550
Beecham, T. R., 588
Bennett, V. D., 520
Benz, C. O., 588
Bignell, L. G. B., 479, 485, 509, 516
Bird, J. C., 603
Blagodorov, M. L., 566
Bossig-Maschinenbau, A., A.-G., 573
Bray, U. B., 588
Broche, H., 595
Brooks, B. T., 470
Brown, C. O., 507
Burk, R. E., 579
Buwalda, J. P., 517

Calingaert, G., 542, 550
Carbide & Carbon Chemicals Co., 603
Card, R. H., 491
Carey, W. F., 573
Carney, B. E., 585
Carpenter, M. T., 579
Carruthers, T. F., 603
Carches, V., 583
Chaney, L. V., 585
Charrin, P., 489
Chase, G. F., 588
Chemical Construction Corpn., 537
Chemical Works (formerly Sandoz), 603
Church, W. L., 507
Clapp, F. G., 508
Clark, L. V. W., 501
Collard, J., 492
Cook, H., 581
Corning, L., 477
Coubrough, G. B., 539
Coutts & Co., 576
Crosby, R. H., 585

Davey, W. S., 599
Day, R. B., 585
Decker, C. E., 474
Deussen, A., 482
Diggs, S. H., 588
Doherty, W. T., 495
Dolbear, C. E., 585
Donlan, T. E., 588
Du Pont de Nemours & Co., E. I., 603

Eby, J. B., 488
Egloff, G., 554
Ehrmann, K., 585
Emrick, B. R., 496
Erdheim, E., 560
Erlikh, B. M., 565
Evans, L. T., 588
Evans, P., 496, 497

Ferris, S. W., 588
Flood, W. H., 591
Florian, E., 558
Forbes, R. J., 589
Forrest, H. O., 585

Ganitski, I., 612, 613, 614
Gardner, J. H., 515
Gas Light & Coke Co., 537
Gluisdenok, —, 534
Godlewicz, M., 561
Gough, H. J., 569
Gray, T. T., 579
Groote, M. de, 539
Gurd, G. W., 588

Haide, M. L., 521
Halbouty, M. I., 498
Harris, J. McA., 586
Hass, H. B., 547, 549
Havel, H., 496
Henderson, L. M., 588
Hladky, J. W., 543
Hodge, E. B., 549
Hoffmann, R. B., 594
Hopper, B., 588
Hopton, G. U., 537
Howard, J. H., 507
Hughes, J. D., 500
Humphreys, H. S., 532
Huntington, R. L., 524
Hutchinson, N. M., 510
Hutchison, K., 537

I.G. Farbenindustrie A.-G., 576, 577
Imperial Chemical Industries Ltd., 573, 603
International Hydrogenation Patents Co., 577
Ivanovszky, L., 546

Johnson, F., 576
Johnson, J. Y., 603
Jones, L. D., 588

Katz, J., 548
Kaunart, P., 538
Keil, K., 600
Kenyon, T. S., 579
Kessler, J. B. A., 611
Kharasch, M. S., 552
King, H. H., 505
Kistiakowsky, G. B., 541, 542
Koppers' Industrielle Mij., H., 537
Krauch, C., 577
Krebs Pigment and Colour Corpn., 603
Kurtz, S. S., 585

Lacey, W. N., 512, 538
Lachman, A., 585
Lamb, J., 600
Lambert, P., 540
Lane, W. C., 503
Lang, F., 582
Larson, L. A., 507
Lecomte, J., 540
Lee, A. R., 597
Leonardon, E. G., 482, 493
Lichtenheld, F. A., 518
Lines, S. C., 526
Lisle, B. O., 531
Loeb, H. D., 573
Loughrey, C. T., 577
Love, P. H., 525
Maass, W., 587
Martienssen, O., 494
McBee, E. T., 547
McBride, R. S., 617
McCarty, B. Y., 588
McClintock, C. B., 511, 514
McFadden, E. D., 507
McGee, J. M., 585
McKissick, W. H., 507
McNeil, C. P., 600
Merrill, D. R., 588
Miclescu, J., 615
Mills, B., 502, 506
Montgomery, S. A., 600
Morrell, J. C., 585
Moser, F. R., 585
Murphy, G. B., 580

Newell, H. D., 571
Newport, C. L., 573
Nicholson, V., 593
Nieuwland, J. A., 551

Parkhurst, G. L., 588
Parks, G. S., 544
Parks, W. G., 548
Pearson, J. M., 528
Pier, M., 577
Piper, J. D., 545
Plummer, W. B., 577
Post, E. S., 480, 519
Pott, A., 583
Potts, H. E., 577
Potts, W. M., 552
Putnam, L. G., 475, 529

Rader, F. L., 590
Reiber, F., 490
Riedel, W., 596
Roberts, J. K., 579
Roe, R. M., 585
Ruhoff, J. R., 541, 542
Rumple, J. M., 537
Ruthroff, R. F., 579

Saal, R. N. J., 596
Sage, B. H., 512, 538
Santillan, M., 476
Sawdon, W. A., 499
Schmitz, W. H., 600
Schulze, W. A., 585
Sherborne, J. E., 538
Silakov, S. M., 570

Skelton, W. E., 538
Smiley, T. F., 487
Smith, C. C., 545
Smith, C. L., 539
Smith, G. R., 479
Smith, H. A., 541, 542
Smith, H. C., 573
Smith, H. G., 538
Smith, L. E., 483
Soll, A., 507
Spalding, J. D., 507
Spicer, H. C., 472
Standard Oil Development Co., 538
Stehr, C. N., 539
Stephens, H. N., 535
Sterling Engine Co., 559
Sterrett, E., 530
Stevens, A. H., 559
Stockman, L. P., 494
Strang, L. C., 568
Stratford, R. K., 538
Stratford, W. M., 535
Stream-Line Filter Co., 538
Strzynski, G. J., 538
Suida, H., 532
Sullivan, F. W., 565
Swift, C. E., 538
Thomas, C. C., 554
Thomas, D. E. F., 545
Thompson, J. W., 533
Todd, S. S., 544
Trask, P. D., 473
Tropsch, H., 554
Union Oil Co. of Calif., 538
Vanderbilt, B. M., 549
Vaughan, W. E., 541, 542
View, C., 538
Vogt, R. R., 551
Wait, J. F., 538
Walther, C., 557
Walther, H., 535
Watts, R. N., 538
Webb, C. Z., 601
Weber, P., 547
Wells, A. A., 535
Wert, S. N. van, 507
Wilson, R. E., 538
Wingfoot Corpn., 603
Winstein, S., 553
Wirth, C., 560
Woods, G. M., 562
Yonker, M. P., 573
Young, C. A., 551
Young, W. C., 553
Zapata, J., 502
Zavoico, B. B., 481
Zobell, C. E., 471

Geology.

552.578.2

470. Origins of Petroleum: Chemical and Geochemical Aspects. B. T. Brooks. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 280–300.—The survival of organic material in oil-shales of great geological antiquity is evidence against the assumption that petroleums have been formed by thermal decomposition of organic material. Trieb has found in many shales, asphalts and asphaltic petroleums convincing evidence of a low-temperature history in the presence of chlorophyll porphyrins. This indicates a derivation or association of petroleum source materials with chlorophyll-bearing algæ or plant life, and implies a shallow-water plankton. It shows also that the materials passed quickly into an anaerobic environment, for chlorophyll is rapidly destroyed aerobically. Many of the hydrocarbons in petroleum are sensitive to heat, and cannot be distilled without decomposition even under good vacuum. Thus petroleums show no nitrogen bases, but their distillates contain them. It is probable that the naphthenic acids in distillates are decomposition products formed from polymers of unsaturated acids originally present in the petroleum source material. Walden believes that optical activity alone is sufficient proof of a low-temperature history.

The organic materials of cannel and boghead coals appear to be almost wholly the products of the polymerization and anhydride formation of fatty acids.

In both the paraffin and olefin series the change from one or a few hydrocarbons to a great many of the same series involves no great amount of net energy change or reaction heat. The presence of benzenoid hydrocarbons is not readily explained. Difference in intensity or duration of thermal action seems quite inadequate to account for the variation in composition of petroleums.

Some of the most prolific fields yield oil from geologically recent strata having bottom-hole temperatures not exceeding 100° F., and being only slightly arched. These temperatures will be higher than when the sediments were deposited, and will be at or near the maximum for the period. No entirely consistent relationship has been found between the composition of petroleum and its depth and age. Pressure in general favours polymerization, and the case with which unsaturated compounds polymerize spontaneously indicates that rather moderate pressures, particularly at shallow depths, may be important. Certain clay minerals aid polymerization.

The evidence is that organic matter as stable as paraffins, waxes, etc., once formed and sealed in the sedimentary rocks, normally undergoes no further changes due to the influence of heat. Accepting this, there is no problem of dispersal, for the constituents of petroleum must have been formed by gradual biochemical anaerobic degradation in the sediments.

The chief types of organic substances which have to be considered as the main source materials of petroleum are: cellulose, starches, sugars, proteins, lignins, oleo-resins, waxes and fatty oil. Proto-petroleum may be expected to be a solid or semi-solid material consisting of a mixture of hydrocarbon oils with polymerized fatty or naphthenic acids. Asphalts are not oxidation products of petroleum, but rather their oxygen content has survived from the original source material. Fatty oils are still regarded as the principal source material, and investigation of asphalt may throw light on the transition stages of proto-petroleum. G. D. H.

551.35: 576.85

471. Vertical Distribution of Bacteria in Marine Sediments. C. E. Zobell and D. Q. Anderson. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 258–269.—The largest number of bacteria observed in the uppermost layer of mud was 420,000,000/gm., and only one sample in 116 had less than 10,000/gm. The overlying water contains only a few hundred per c.c. even where most abundant (at depths of 10–50 m. below the surface). At depths below 200 m. the water contains very few bacteria. The presence of utilizable organic matter greatly influences the number of bacteria in the sediments. Within the limits of the observations (to 2000 m. of water) the number of bacteria in the deposits is unaffected by depth of water. At times they increase with depth, where the temperature is 3–7° C. as contrasted with the higher temperature of shallower water. Low temperature retards development, but favours prolonged survival. Marine bacteria are physiologically active, and multiply at temperatures below zero. Neither pressure nor its release in bringing them to the surface destroys them. The abundance of bacteria is related to the grain size and organic content of the sediment, there being more bacteria in clays than in sands. There may be a thousand-fold variation in a distance of 2–3 cm. horizontally in a core, probably due to uneven distribution of the nutrient.

The top 3–5 cm. of deposits contains most bacteria, and the top millimetre is probably the zone of maximum activity, for there oxygen can be absorbed from the overlying water. The number of bacteria decreases rapidly below 5 cm. Generally aërobes predominate, but it is not possible to compute the number of facultative anaerobes. The sediments showed the absence of free oxygen in the interstitial water, and the oxygen-absorbing capacity, both chemical and biological, decreases with depth in the sediment. The state of reduction in the sediments is shown to increase with depth of burial, and the reducing intensity also increases. Bacteria are the main agents influencing the oxidation–reduction potential of the sediments, and this potential effects certain geological, chemical and biological processes.

Approximately one quarter of the bacteria isolated were proteolytic. In most samples 5–15% were capable of reducing nitrates and nitrites, but few liberated nitrogen from these. Nitrifiers occur only at the top of the cores. Lipolytic species were found. They assimilate the glycerol, but it is not known that they attack the fatty acids. There were generally sulphate reducers, cellulose decomposers and methane producers. The organisms were mostly unable to ferment simple carbohydrates, although 25–50% were able to hydrolyse starch.

Bacteria from deep layers were much slower in development and multiplication. Most forms from the top layer were obligatory halophiles, requiring sea-water to multiply, and very sensitive to changes in salinity. The bacteria from deeper layers would grow in either sea- or fresh-water media, and survived for long periods in waters less salty than sea-water. G. D. H.

550.361

472. Rock Temperatures and Depths in the United States. H. C. Spicer. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 270–279.—The tables give computed temperatures for depths of 5000 and 10,000 ft., and the depth of attaining 212° F. Calculations are by the equation: $y = a + bx$, where a is the computed annual mean temperature just beneath the earth's surface, in °F., and b the geothermal gradient in °F./ft. A least-squares adjustment of the straight line was made to all the observations in a well. From the group of results available for each location two sets of constants a and b were selected—one giving computed maximum temperatures, the other computed minimum temperatures for depths of 5000 and 10,000 ft., and also the maximum and minimum depths of attaining 212° F. Results are given for some 162 fields in 24 states, maximum values having been calculated for all and minimum values for only about half of them.

The errors of interpolation of depth–temperature curves are probably less than 1° F. in most cases, but the extension of the curves to greater depths may lead to large errors, for depth–temperature curves near the earth's surface are seldom, if ever, straight lines.

Temperature gradients are assumed high on anticlines and low on synclines. Few observations have been made on synclines, for most of the data are from oil-field

anticlinal structures. It is probable that the computed temperatures in these tables will therefore be more representative of a maximum, and in the structural basins the minimum temperatures will be lower and the depths to 212° F. greater.

The results bear out Van Orstand's view that 212° F. is frequently attained at less than 10,000 ft. This is the case in two-thirds of the localities. If 212° F. is reached at less than 7000 ft., the critical temperature for water (689° F.) is calculated to occur at less than 30,000 ft. For curves giving 212° F. at 10,000 ft. or less, this critical temperature will usually be attained at less than 40,000 ft. G. D. H.

552.578.2(794)

473. Proportion of Organic Matter Converted into Oil in Santa Fe Springs Field, California. P. D. Trask. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 245–257.—The mass of sediments likely to have given rise to oil at Santa Fe Springs seems to have covered 50 sq. miles with an average thickness of 4200 ft., being limited by the adjacent synclines, the south-east plunge of the structure and possibly a fault on the north-west. It is assumed that no migration has occurred across this possible fault. The generating sediments are seemingly confined to the sequence in which oil is now found. There are eight producing zones between 3500 and 7700 ft. on the crest, the lower 300 ft. being Miocene and the upper part lower Pliocene. The individual zones are underlain by water and capped by shale. The oil content of one of the cap shales is extraordinarily small, and it seems that little oil is migrating through the cap shale. In the five lower zones the ratio of oil to organic matter is approximately constant, rather discounting upward migration. Sediments above the oil zones are barren, even where there are sand bodies. The zones differ in pressure.

The initial oil content is computed as 1,365,000,000 brl. To obtain this each pound of sediment must have given an average of 0·00053 lb. of oil. Pending proof to the contrary, it seems wise to take the present organic content of this mass of sediments as 1·8%, but if the anticline was growing during sedimentation, it is probable that the organic content of the synclines would be much higher than the value assumed in deriving the above figure. The average organic content of 2000 recent samples was 2·5%; of ancient samples 1·5%. Therefore burial leads to a loss of about 40%, and hence the original organic content at Santa Fe Springs may have been 3%. This assumes uniform distribution and sufficient time to give 40% conversion.

Some of the oil formed may not reach the reservoir, and this quantity adsorbed, destroyed or escaped is difficult to estimate. The whole of the 40% loss on burial does not become oil. Some forms water and carbon dioxide. It is improbable that more than one-third of the loss becomes petroleum. As a consequence, it is inferred that the yield of oil is 2–15% of the organic content.

Bacteria can destroy oil, but it is a matter of dispute whether it can occur underground or not. Bacteria can live near oil pools. Any such destruction would be mainly during migration, since it is improbable that conditions would be favourable within the body of the oil. The temperature may be too high for bacteria, and the probability is that such destruction will not be important.

The cleanness of water sands down dip argues against much retention of oil by adsorption during migration. Base exchange may aid the displacement of oil from mineral grains. Allowing for all factors, the loss during migration is perhaps 50% of the amount of oil that reaches the field.

At Santa Fe Springs the most probable yield of oil by the organic constituents of the sediments seems to be of the order of 4%, with possible limits of 2% and 15%. It does not follow that the beds have generated all the oil they can generate or that the yield of oil is the same as in other fields. G. D. H.

563.71: 551.7(767)

474. Some Tentative Correlations on the Basis of Graptolites of Oklahoma and Arkansas. C. E. Decker. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 301–311.—A very significant graptolite horizon has been found near the middle of the Arbuckle limestone, about 4600 ft. below the top. Colonies of dendroid or branching types only were obtained. A table of graptolites is given which seems to connect this part of the Arbuckle with the upper Cambrian of Wyoming, Wisconsin, Minnesota, Tennessee, South Dakota,

Vermont and Quebec, but other fossil evidence would place the Cambrian–Ordovician contact several hundred feet below the graptolite zone, though even that would be 3000 ft. or more above what has usually been accepted as the junction of late.

About 3700 ft. higher and 800–900 ft. below the top of the Arbuckle is Didymograptus protobifidus zone, about 30 ft. wide. Phyllograptus anna was found in the lower part of this zone. In Oklahoma this zone is nearly 1000 ft. below the true Didymograptus bifidus–D. artus zone, which is well above the Joins formation of the Simpson group.

Didymograptus artus and D. bifidus have been found in the Joins formation of the Criner Hills in a zone now believed to be of Beekmantown age. The latter also occurs in the Black Rock limestone of Arkansas.

Dicellograptus mensurans has been found in the upper part of the Bromide formation, thus making this upper part of the Simpson equivalent to the basal Normanskill shale of New York, the lower Stringtown shale of Oklahoma and the Womble shale of Arkansas. A second table shows that the middle and upper parts of the Stringtown shale are equivalent to the basal part of the Viola limestone. If the identification of D. mensurans in the upper part of the Bromide of Criner Hills is correct, the unconformity between the Bromide and the Viola must be of shorter duration in the Arbuckle than was believed formerly.

Several graptolites in addition to Cryptolithus tesselatus pass from the upper part of the Viola proper into the Fernvale phase at the top. Since basal Viola is correlated with Stringtown shale, the evidence points to the rest of the Viola being correlative with the Trenton, Utica and Lorraine; and the Fernvale with the Richmond. The Big Fork of the Ouachita mountains seems equivalent to a part of the Viola limestone of the Arbuckles. Graptolites link the Sylvan shale of the Arbuckles to the Polk Creek shale of the Ouachitas, and in turn to the Maquoketa and the upper Ordovician of England.

The Blaylock graptolite zone is lower Silurian, considerably above the base. The Henryhouse shale of Oklahoma has a Silurian graptolite fauna, which places it much higher in the Silurian than the Blaylock sandstone of the Ouachita mountains in Oklahoma and Arkansas. G. D. H.

553.982 : 553(68)

475. South-East Africa : Oil Possibilities. L. G. Putnam. *Oil Weekly*, 9.3.36, **80** (13), 46.—A well is being drilled near the station of Inhaminga, about 113 miles north of Beira, Portuguese East Africa. In February it had reached a depth of 3800 ft.

The presence of a structural break in the regional south-east dip was noted in 1912 and investigated further in 1921. Three structural test-holes were put down, and a fourth in search of oil failed due to mechanical and financial difficulties.

Detailed geological work and gravimetric and seismograph surveys have shown a fault structure similar to the Mexia–Tehuacana fault zone. A structure 34½ miles long, with a maximum width of 3 miles, has been mapped. The closure seems to be about 200 ft. for the surface beds. North-western closure is afforded by a fault zone with several well-defined normal faults en echelon, and downthrown to the north-west by amounts ranging from a few to 700 ft. The structure seems to be related to the Great Rift system. Some of the faulting is comparatively recent, though it may have begun in Mesozoic times. The strata observable are: (1) Inhaminga grits (age unknown); (2) Eocene limestone; (3) upper Cretaceous chalk; (4) Cretaceous grits. Below are Jurassic beds and members of the Karroo system, Triassic to upper Carboniferous. The Jurassic is definitely marine in the north-eastern part of Portuguese East Africa and eastern Tanganyika, as well as in Madagascar where oil seeps occur in its base.

The well is located 800 ft. south-east of the most easterly fault and opposite the area of the beginning of the north-east plunge. It starts about 200 ft. below the base of the chalk, and seems to be approaching the base of the Cretaceous grit series. First hopes are for Jurassic oil, and failing this, the Karroo which, although estuarine to the north-west, may be marine under this area and to the south-east. If this area fails, an area to the south-east, about 100 miles by 60–80 miles, with a more basinward position and with marine Eocene and Cretaceous chalk under cover, still holds possibilities. G. D. H.

55(72)

476. The Geology of Mexico. M. Santillan. *Oil Weekly*, 23.3.36, **81** (2), 35–41.—The Central Plateau of Mexico, which reaches a height of 2600 m., is bordered by the Western Sierra Madre and the Eastern Sierra Madre. To the south is the Yucatan Peninsula, an extensive plain with a slight dip northwards. On the extreme west lies the Lower California Peninsula, a mountain system with a N.W.–S.E. trend bordered by wide desert-like plains.

In the main the Western Sierra Madre is covered by igneous rocks of Tertiary and Post-Tertiary age. Only a few exposures of Mesozoic and Palæozoic sediments are known in this area. The mountains of the Central Plateau are largely composed of Mesozoic with a few Palæozoic sediments, the valleys being mainly Quaternary gravels with isolated patches of effusive igneous rocks. The Eastern Sierra Madre is principally Cretaceous limestones and shales, but in places deep erosion has exposed Palæozoic occasionally intruded by igneous masses. No igneous rocks have been found in the Yucatan Peninsula, which is covered by sediments of Tertiary to Recent age. On the other hand, intrusive and effusive rocks brought up through Cretaceous and Tertiary sediments almost cover the Lower California Peninsula.

Rocks of Proterozoic age are found mainly in the Western Sierra Madre, and are much folded and faulted. The Palæozoic is very limited, and is represented mainly by sediments. Mesozoic sediments were probably deposited over most of Mexico, but later volcanic activity has, to a great extent, covered them in the west. The Jurassic and Triassic are not so well represented as the Cretaceous, the latter being the most widespread. Many of the petroliferous and metalliferous horizons are found in the Mesocretaceous which is composed chiefly of highly fossiliferous dark grey to black limestones. Severe folding and faulting of these limestones have led to solution by circulating waters, resulting in increased porosity, a factor which is thought to be of primary importance in the oil-fields of Tampico and Tuxpan areas.

The Eocene of N.E. Mexico is composed of great thicknesses of marine shales and sandstones. Gas fields from these beds have been developed in northern Tamaulipas, and it is hoped that the lower Jackson will give oil production in this area. Folding movements after the close of Cretaceous times were so intense that the anticlinal and synclinal axes became weakened, and during Pliocene and Miocene times these weakened areas formed lines of lava flow. The Quaternary is represented in the valleys and along the coast by sands, clays, etc., and in many regions recent volcanic activity has produced tuffs, breccia and basaltic glasses. J. A. G.

553.982 : 553(764)

477. Plymouth Area Reserves. L. Corning. *Oil Weekly*, 30.3.36, **81** (3), 30–34.—This area in the N.E. part of San Patricio Co., Texas, was surveyed by geophysical methods and first tested in 1935. Geological work proved almost useless owing to lack of exposures, the area being almost entirely covered by Beaumont Clay.

Contours on top of the Heep Sand indicate an anticline about 3 miles in length, with an uplift of 300 ft., trending in a N.–S. direction. Differences in depth of marker horizons has led to the conclusion that faulted conditions exist in the southern end of the structure, and the thickening of some of the beds may indicate the presence of a down-thrown block or graben.

Production is from three horizons. The Plymouth Sand (5500 ft.) varies from 5 to 13 ft. in thickness, and is a prolific oil producer with very little gas. Its estimated porosity is about 20%, and is expected to give a recovery of 10,000 brl. per acre. The Heep Sand (5600 ft.) is very uniform over the area, and exceptionally clean and porous. Its exact thickness is unknown, but is estimated at about 100 ft. On the crest of the structure the upper 30–40 ft. contains gas, but on the flanks this thickness of gas sand decreases. The average thickness of the oil-producing section is given as 20 ft. Tests on cores from this sand show a porosity as high as 34·5%, and estimated recovery is 20,000 brl. per acre. The Magnolia (5900 ft.) is very similar to the Heep Sand, but has not yet been tested in the northern part of the structure. Recovery per acre is also expected to be similar to the Heep Sand.

In the Taft Area, to the south of the Plymouth structure, a well was drilled into a productive sand at 4901 ft. This horizon is referred to as the Greta Sand. Attempts to develop production north and eastwards have so far failed, and further tests will

probably be confined to the south-western area. This structure is thought to be entirely separate from that at Plymouth. J. A. G.

553.982 : 553(763)

478. The Conroe Trend. G. R. Smith. *Oil Weekly*, 16.3.36, **81** (1), 61–68.—In the section of the Conroe Trend which extends from Lavaca Co., Texas, to Rapides Parish, Louisiana, geophysical and geological work has proved very difficult, and it is suggested that a closer alliance between the two sciences would help to solve many of the major problems.

In this area, which is about 330 miles long by 40 miles wide, definite evidence of folding and faulting is known, and the author is of the opinion that many more favourable trapping structures will be found.

Most of the wells drilled have been abandoned in the Cockfield formation, despite the fact that there are possibilities in the Lower Yegua, the Cook Mtn., the Mt. Selman and the Wilcox formations. All these horizons are productive on the western part of the Conroe Trend at Clay Creek field.

The structure and production history of the following fields are discussed : Brenham Salt Dome, Clay Creek, Raccoon Bend, Katy-Brookshire Area, Hockley Dome, Tom Ball, Conroe, Willis, Cleveland, Livingstone, Ace, Cheneyville, and Pine Prairie. A detailed composite well-log compiled from the wells drilled on the Conroe field is also given. J. A. G.

622.323(764)

479. Pearsall Field, Texas. L. G. E. Bignell. *Oil & Gas J.*, 19.3.36, **34** (44), 15–16.—A large structure in this area is now producing both oil and gas, and the discovery wells have so far proved an area about 14½ miles in length. Four of the wells are producing from the Navarro Sand at 3850 ft., one from the Buda Lime at 5883 ft., and four from the Austin Chalk at about 5400 ft. Of the others one is a gas well in the Edwards Lime. A table of twelve well logs is given, with details of initial production. J. A. G.

622.323(76)

480. Producing Zone Selection. E. S. Post. *Oil Weekly*, 2.3.36, **80** (12), 32.—The proper selection of the best producing area of the sand in completing wells is especially important in the Gulf Coast and South Texas districts, on account of the fact that the gas, oil and water are so close in many instances that one regulation location finds the gas/oil ratio problem changed into an oil/water problem. Sand selectivity has materially reduced these production problems.

Operators in these territories are generally drilling their wells to the desired depth so as to study all the sections, and casing is run and cemented on bottom, after which the gun perforator is used to open up the right producing section. Coring and testing will indicate clearly the best portion of the sand to be tapped. L. V. W. C.

553.982 : 553(764)

481. Geology and Economic Significance of East Texas. B. B. Zavoico. *World Petr.*, 1936, **1**, 94–147.—The technical development and economic significance of the East Texas oil-field are discussed at some length. Drilling and producing practices and costs in the area are reviewed. The question of water encroachment is considered. Lists of refineries and natural gasoline plants at East Texas are given. A plane table map of the field accompanies the article. W. W.

553.982 : 550.837

482. Use of Electrical Logs for Correlation in the Gulf Coast of Texas and Louisiana. A. Deussen and E. G. Leonardon. *A.P.I. Prod. Bull.*, Nov. 1935 (216), 13.—This paper discusses and illustrates by means of a few examples the use of the Schlumberger electrical logs for the purpose of establishing geological correlation. These surveys are now widely used in the Gulf Coast of Texas and Louisiana for this purpose, and supplement efficaciously the lithological and palæontological conclusions. W. W.

553.982

483. Stratigraphic Traps for Future Oil Reserves. L. E. Smith. *Nat. Petr. News*, 25.3.36, **28** (13), 24 C.—Defines a stratigraphic trap as one in which a variation in the stratigraphy is the chief confining element to form a reservoir trapping the oil. All oil and gas found up to date occur in gravity adjustments within their containing reservoirs; in some the dominant trap-forming element is a wedging or pinching out of the sand reservoir rock, lateral gradations from sand to shale or limestone, an uplift, truncation and overlap or similar variation in the stratigraphic sequence.

B. F. N. M.

553.982 : 553(794)

484. High Gravity Green Oil is Discovered in Kern County. L. P. Stockman. *Oil & Gas J.*, 12.3.36, **34** (43), 79.—Geophysical exploration has not yet proved successful in disclosing any new oil-fields, but has discoverd several dry gas-fields, and it is probable that one of these "highs" yet to be indicated by geophysics will have both gas and oil. The seismograph only began to be used generally during the past year, the reflection method being mainly adopted, twenty crews being at present at work. Five of the big oil companies are actively searching for structure by geophysical methods.

A well on the Corning anticline in Tehana County is remarkable in that from 2600 to 7000 ft. the operators have cored virtually homogeneous shales, with but few sandstone partings which had gas. A new type of shale was encountered between 5300 and 6500 ft., crowded with diatoms, radiolaria and foraminifera. The matrix in which the fossils were embedded was composed mainly of small rounded globules of pyritic replacement. Geologists consider a marine shale like these 1200 feet to be a rare occurrence.

In Kern County a new discovery has been made. Practically all the crude oil in California is black with asphaltic base. In a well 9492 ft. deep, below the Oligocene Wagon-wheel zone, in rocks believed to be Upper Eocene, a green oil of far superior quality to other California oils has been encountered. The Union Oil Co. is employing both the seismograph and electrical induction methods, and as this well is not too favourably situated with regard to structure, it is hoped that higher up the structure may prove a good oil-field in this valuable oil.

B. F. N. M.

553.982

485. Characteristics of Oil Reserves give Data on Reserves to be Recovered. L. G. E. Bignell. *Oil & Gas J.*, 20.2.36, **34** (40), 36.—The important influence of gas dissolved in oil in changing the resulting fluid mixture has been studied by the U.S. Bureau of Mines. The change in the viscosity of the oil through gas escaping from the solution affects both surface tension and sp. gr. to the detriment of recovery. The substitution of "pressure drop" curves for the old "production decline curves" has enabled determination to be made not only of the oil still in the reservoir, but also of the quantity of oil and gas originally in place in the pool. The advances in technique are briefly mentioned.

B. F. N. M.

553.631

486. Origin and Tectonics of the Saliferous and Petroliferous Terrains. H. Havel. *Rev. Petr.*, 11.4.36, **678**, 551–554.—The principal saliferous regions which have been studied by petroleum technologists are first described in the following order of importance: The Gulf of Mexico, Germany, Rumania, N. Africa, Persian Gulf, Palestine, Egypt, Farsan Islands, U.R.S.S., Central America and Italy. Then the various theories which have been propounded are briefly set out.

The author then gives his own theories for the enormous agglomerations of salt by first pointing out that anhydrite is found in these old salt domes, but is not deposited in any salt marshes in present times. Anhydrite can be precipitated at a temperature of 30° in the presence of magnesium chloride, also at a temperature of over 300°. Contrary to the general opinion, geosynclines are not born in the principal seas, the mountain chains are always pinched between the divisions of the continental crust. During the periods of expansion the endothermic bodies in the centre of the globe disintegrate towards the periphery, rapidly giving off enormous quantities of heat.

During fusion the bottom of the crust, particularly the bottom of certain seas, is completely liquefied, and some divisions of the crust begin to move away. This movement, pace Wegener, can produce no mountain chain in front of the divisions. These can only be born during contraction periods, during which the fractures which were opened during expansion and into which the sediments could have been crammed under great thicknesses, close again because of their relative narrowness, resulting in an intense folding of the sediments and their almost complete expulsion from the fracture. Following the diminution of crustal thickness, at the time of fusion the fractures reach the liquid magma, and that, under the contraction pressure, irrupts both in the geosynclinal breaks and in the narrower fractures of the crust to form the crystalline rock cores which are found in mountain massifs, and the dykes and laccoliths of eruptive rocks of the continental crust. The enormous pressures due to contraction cause the light elements to recombine at the centre of the earth and to re-absorb enormous quantities of heat, the terrestrial crust cools again and forms a continuous envelope round the magma.

It is then argued that, during the expansion periods, the bottoms of certain inland seas, or of gulfs and inlets, could become liquid, and that the injection of magma at the start of contraction periods would evaporate the contained water, causing the precipitation of the dissolved salts in the recognized sequence of sea-water evaporation, *i.e.* alkaline chlorides first, then the sulphates and carbonates; this last stage precipitation of the sulphates and carbonates would explain why the gypsum and limestone form the cap-rock covering the saliferous formations. In these desiccating seas the temperature can exceed 300°, and the gypsum could be transformed into anhydrite and the limestone into lime. The injection of the magma which evaporates the water would account for the presence of eruptive rocks in the salt. If the fused rocks come from the sial base of the continents, gneisses and granites would be present, if from the magmatic sima, in which the solid crust of the continental sial is plunged, basic rocks (diabase, ophites, etc.). During orogenic contraction periods, the salt beds, if on the lips of the geosynclines, would fold like other sedimentary beds, but mostly they are differently folded. During the lengthy contraction period the deposits on the salt beds are their own offspring, but with the abatement of temperature, anhydrite and lime are gradually hydrated, thus enormously increasing in volume, consequently the covering sedimentary beds could be raised up and broken where the anhydrite and lime were greatly amassed, to form the characteristic salt domes. At the places where the sedimentary cover has yielded to the anhydrite push, or under the action of heaping up or of orogenetic push, the salt has been able to penetrate its own cap-rock so as to form diapir folds. Under the weight of sedimentary terrains and under the continuous and progressive hydration of anhydrite, diapir folds can continue still at the present day to flow towards the surface.

The resistance to the salt during the volume increase of the hydrating anhydrite explains very well the distorted form of the diapir folds, and also the breccia appearance of the eruptive rocks which are scattered sometimes in the mass, sometimes on the surface, of the salt, having undergone a veritable trituration. This is an explanation of all the characteristics of the saliferous formations. It has been maintained that the salt is often insufficient in quantity to explain the diapir fold formation. The answer to this is that the mother-salt-bed is perhaps too deep and has not been discovered yet by the bore hole.

Lagoon sediments are formed principally at the end of orogenic contraction periods by solar evaporation. Diapir formations of deep seas are formed at the beginning of the same periods by the internal heat of the globe.

It is not agreed that the salt must be older than the sedimentary terrains. The presence of gneiss and granite above the salt is of no significance. The rocks are generated by fusion of the continental sial, and while there are Archæan granites, there are also Primary up to Tertiary similar rocks. The explanation of saliferous domes necessarily comprises that of the petroliferous beds and sulphur deposits which almost always accompany the salt. The inland seas are often crowded with organisms of all sorts. These organisms, both by the rise in the degree of salinity in the waters and of the temperature, have been very quickly killed, and could have been preserved in the salt until the temperature becoming sufficiently high has distilled them, to give birth to the gas and hydrocarbons which would condense in the upper cold parts where the sediments heap up on the salt.

The anhydrite and gypsum can in part have been reduced by the hydrocarbons to give birth in part to the sulphur, so often found in these beds. B. F. N. M.

553.631

487. Plastic Flow Theory in Explanation of Salt Domes on the Gulf Coast. T. F. Smiley. *Oil & Gas J.*, 20.2.36, **34** (40), 48.—Some theories are concerned with the causes and manner of salt dome uplift apart from the ultimate source of the salt or origin of the cap-rock, which are associated problems. Other theories comprise the igneous intrusion and the crystal growth theories but the plastic-flow theory is in more favour with geologists than either of these two.

Summarizing Dr. E. R. Lilley in "Geology of Petroleum and Natural Gas": The plastic-flow theory looks upon the salt masses as solely extreme types of folds in incompetent strata. The outlines of the salt masses in any particular area are the direct reflection of the tectonic conditions of that area, a form normal to one area is not necessarily found in the other. Resulting forms may differ within one section, due to application of different forces. The movement of the salt is caused by either isostatic conditions,—uplift suggesting that the sale has been squeezed up through lines of weakness due to the greater density of overlying sediments or orogenic conditions which generally result in lateral thrusts. In the outer arc of the Carpathians the application of lateral thrust is very evident. The Gulf Domes are markedly circular in form, such as would be probably the result of lateral compression from different directions at right angles to each other. The strata of the Gulf area give no evidence of such compression, so the compression theory in this area is hard to accept.

The plastic-flow theory needs for its maintenance the adoption of the view that the difference in result is due to the application of the forces to the underlying basement rocks rather than to the overlying. The author believes that the force acting on the salt beds to induce their upward movement will be a combination of isostatic pressures plus movement within the deep competent beds and within the shear zone along old lines of weakness. B. F. N. M.

Geophysics.

550.83(764)

488. The Geophysics of the Tomball Oil-field, Harris County, Texas. J. B. Eby. *Geophysics*, Jan. 1936, **1** (1), 149–158.—Two or three shallow wells were drilled several years before the field was brought in, but the actual discovery of Tomball is considered an unqualified geophysical find. The credit for the discovery is given largely to torsion balance, although the picture was checked by both the refraction and reflection seismographs before drilling. The location and character of the field, its topography and geological features, the torsion balance, the refraction seismograph and the reflection seismograph work are described and five figures illustrate the work.

The first deep well was recommended late in 1932, located in 1933, and before completion the discovery well (Kobs) was started in March 1933. The reflection geophysical survey is considered to have outlined the Tomball structure remarkably well. B. F. N. M.

550.83(76)

489. The Geophysics in the Gulf Coast in 1935. P. Charrin. *Rev. Petr.*, 11.4.36, 675, 549.—Revising the figures given in the previous papers (Abs. 345). Tables are given showing 17 new proved discoveries in 1935, 10 in Texas, 7 in Louisiana, all of which were included in the "prospects" in the previous paper. These added to the 69 geophysical discoveries to the end of 1934 make a total of 86 geophysical, as against 54 fields of the old methods. In spite of the new discoveries, the number of "prospects" has not diminished, and is estimated now at 150. 1935 has supplied entirely favourable new results with regard to the productivity of the geophysical domes.

During 1935 in the geophysical fields:

(1) The number of discoveries has increased from 69 to 86.

(2) In the first category 6 fields have increased their production in 1935 enormously (4 more than double, 1 over 6 times, 1 over 8 times), over that of 1934. 1 field exceeded 6 million brl., 2 over 2 million brl., 2 over 1 million brl.,

compared with only 2 over 1 million brl. in 1934. 2 fields have gone down to the second category (feeble producers).

(3) 6 fields have passed from the second category to the first category, one exceeding the million-brl. mark.

(4) From the third category 3 have been transferred to the second category.

(5) Of the 17 new fields: 5 are placed in the first category, 10 in the second (of which 5 have produced oil and 5 are being developed). The other 2 in the third category, dry or have produced only gas.

These figures confirm the optimistic views expressed in the earlier two articles.

Finally a comparison of the Texas–Louisiana productions for 1934 and 1935 by the geophysical fields and by the others is made, which shows that:

In 1934 for the whole Gulf Coast	the Geophysical production was	29,487,000 brl.
" " " "	the old methods " "	46,016,000 "
	Total	75,503,000 brl.
In 1935 for the whole Gulf Coast	the Geophysical production was	53,200,000 brl.
" " " "	the old methods " "	43,218,000 "
	Total	96,418,000 brl.

This is an increase of 20,915,000 brl. for 1935 over 1934, but the geophysical fields increased by 23,713,000 brl., whereas the old methods declined by 2,798,000 brl. in spite of two of their fields producing 1,141,000 brl., three times their production in 1934.

The expenses for geophysical work in 1935 was estimated at 7 to 8 million dollars, therefore allowing $1/brl. on an average for the oil, the geophysical increase of over 23 million brl. will cover the survey expenses approximately 3 times over.

It still seems reasonable to estimate the ultimate recovery of the oil from the geophysical fields at 2000 million brl. B. F. N. M.

550.834

490. A New Reflection System with Controlled Directional Sensitivity. F. Reiber. *Geophysics*, Jan. 1936, **1** (1), 97–106.—A perfect Reflection system in which a simple impulse would travel downwards until it encountered a series of simple strata, from each of which a reflection would be returned to the surface is not yet evolved, and is scarcely ever approximated, since the direct wave from the explosion does not pass the receiving system before any reflected waves arrive; consequently it causes interference with the reflections, which makes a complex visual record. The object of the new system is to employ a controlled directional sensitivity in order to break down the complex combination of waves arriving from various directions, so as to separate the waves and identify a majority of them, thus giving as nearly as possible an accurate picture of the geological structure. The usual reflection method, using directional reception by group geophones, while being satisfactory in regions of flat-lying strata, in steeply folded and faulted rock areas cannot separate the waves by its simple visual record, hence the necessity for the additional factor of controlled directional sensitivity.

After describing the operation now in use with the ordinary type of reflection seismograph, an account is given of the working of the new system and is illustrated by eight explanatory figures. B. F. N. M.

550.837

491. Earth Resistivity and Geological Structure. R. H. Card. *Electrical Engineering* (*Amn.*), Nov. 1935, **54** (11), 1153.—This is a study based on many experiments from which much data was obtained to elucidate the relation which the resistivity of the earth's crust bears to geological structure. Earlier study was confined to areal geology —that is, to the strata lying immediately below the soil and loose surface materials. This was found to be insufficient because of numerous discrepancies not satisfactorily

explainable. The said experiments carried out at considerable depths were then made. Analysis of the data obtained, giving effective resistivities by mutual impedance, indicates fairly consistent relation between the resistivity at any given point and the age and physical characteristics of the geological formations involved. In general, decreasing effective resistivity corresponds approximately to decreasing age of the formations. The resistivity varies between wide limits, and is not always the same even for the same type of rock formations in different localities, but the variation for any particular material is within narrow limits, and the older materials usually have the higher resistivities. The effective resistivities are given as follows :—

	Metre-ohms.
Pre-Cambrian and combinations of Pre-Cambrian and Cambrian	1,000–10,000
Cambrian and Ordovician combinations	100– 1,000
Ordovician to Devonian inclusive, and combinations of these periods	50– 600
Carboniferous, Triassic and combinations of Carboniferous and earlier periods	10– 300
Cretaceous, Tertiary and Quaternary and combinations thereof	2– 30

Individual strata at any point cannot be considered independently, and it seems that very precise determinations cannot be made. Structural abnormalities such as faulting, crumpling and folding and volcanic intrusions and other factors affect the resistivities to a great extent. B. F. N. M.

550.837

492. A Search Coil Method of Measuring the A.C. Resistivity of the Earth. J. Collard. *Journal Inst. Elec. Engrs.*, Jan. 1936, **78** (469), 100.—A description of the method of measuring the A.C. resistivity of the earth on the Carson-Pollaczeh theory for the mutual impedance of earth return circuits. The method consists in the measurement of the e.m.f.'s induced in a search coil at various distances from an earth return circuit carrying alternating current. The experimental points are superimposed on a set of theoretical curves calculated for different values of resistivity, and the curve with which the points coincide gives the resistivity.

The method has been used to measure the resistivity of the earth at various sites in England and Italy.

The results are given in Table I, showing the resistivity in ohm-cm. and the geological formation at each site, and Table II gives the resistivity in ohm-cm. of the various geological formations, varying from a minimum for alluvium of 200–400 ohm-cm. to a maximum for igneous rocks of 50,000–100,000 ohm-cm. B. F. N. M.

553.982 : 550.361

493. The Economic Utility of Thermometric Measurements in Drill Holes in Connection with Drilling and Cementing Problems. E. G. Leonardon. *Geophysics*, Jan. 1936, **1** (1), 115–126.—Geophysical methods aiming at more exact and fuller information of the conditions in drill holes have made great progress in the past few years, by improving the reliability of directional surveys. Electrical surveys have successfully studied the directional dip of strata as well as their nature and content. The temperature is one of the physical parameters not yet very extensively used which might give useful data. The paper then describes a suitable method and operating technique, together with the practical apparatus, explaining the principle of the instrument, and a few examples of the work and of the results it attained, which are illustrated by six figures. It is conceded that the process is not yet developed to the extent that the many problems which may be tackled can be easily solved and utilized by commercial exploitation. Further study and extensive operation under various practical conditions will be needed to establish the soundest operating technique and the exact interpretations of the anomalies. However, the results which have already been attained are encouraging. B. F. N. M.

550.837 : 608.3

494. Patents on Geophysical Methods. Method and Device for Differentiating between Geologic Strata traversed by Bore-holes. O. Martienssen. U.S.P. 2,018,080, 22.10.35. Fifteen Claims. (First claim : Method of exploring characteristic differences

between different geologic strata traversed by a bore-hole, consisting in moving a generator of high-frequency oscillations and an appertaining radiator of a high-frequency field of force through the bore-hole to successively expose each stratum individually to the field of force produced by said radiator, locally converting the different electric reactive effects produced on said generator by the different reactions of said field to the different strata characteristics, into correspondingly varying electric forces non-reactive on said high-frequency generator, transmitting said electric forces from the different points of exploration to the points of observation, and there observing the variation of said forces as a measure of the varying character of the traversed strata. The fourteen other claims give each a detail of the method and device which goes with the above claim to make up the full benefit of the invention.) B. F. N. M.

Drilling.

622.245

495. Improvements in Drilling Technique and Equipment During 1935. W. T. Doherty. *A.P.I. Prod. Bull.*, Nov. 1935 (216), 21.—This paper constitutes the annual report for 1935 of the Topical Committee on Drilling Practice. The following topics are briefly considered:

Reconditioning of Wells. Improvements in well-reconditioning methods have been most evident in cementing and in practices designed to prevent contamination of the producing formation by water or clay muds. The utilization of various formation-testing and -sampling devices and the selection of proper rig equipment have reduced the time required for work-overs.

Drilling Fluid. Loss of returns when drilling permeable formations necessitates the addition of some admixture to the rotary fluid, the choice of admixture depending on the permeability of the particular formation in which returns are lost. Standardization of methods, instruments and terminology for measuring drilling-fluid characteristics should be practical and of value to all operators. Progress during the last two or three years shows that both drilling fluids and methods must be considered in attempting to drill heaving shale.

Drilling Factors Contributive to Drill-Stem Failures. It is believed that most drill-stem failures are due to fatigue caused by lateral deflection (bending) and impact while rotating, the latter being often caused by jumping of the pipe when drilling a hard formation. Bending is caused principally by excessive rotational speed, and by compression in the drill stem when considerable weight is carried on the bit. Crooked holes often contribute to drill-stem failures. In this paper are discussed briefly the actual nature of the failures, together with recent improvements in drill stems intended to reduce the frequency of failures.

New Advancements in Rotary-Drilling Equipment. Deals with the application of industrial type internal-combustion engines to rotary drilling and a direct steam-driven rotary unit which has recently been placed on the market.

Existing Rotary-Drilling Problems. The following existing drilling problems have been selected by the Drilling Practice Committee for consideration for further study during 1936; Reconditioning of wells; drilling fluid; drill-stem failures; inefficiency of steam drilling rigs; direct-drive diesel rotary rigs; casing-joint leaks in deep high-pressure fields. W. W.

622.248.1

496. Drilling and Fishing under Pressure at Masimpur. P. Evans and B. R. Emrick. *J.I.P.T.*, 1936, **22**, 187–188.—An abstract of a paper read before the Burmah Branch on drilling problems presented by the occurrence of heaving and squeezing shales, high-pressure water and gas sands, low-pressure zones, steep dips and hard rocks. G. R. N.

622.245.33

497. Rotary Drilling Fluids. P. Evans. *Sands, Clays and Minerals.* April 1936, 2 (4), 9–22.—In three-quarters of a century the depth of oil-wells has increased from a

maximum of a few hundred feet to over two miles, and improved technique to meet increased difficulties has become necessary.

The characteristics of percussion, core and rotary drilling are outlined. Rotary drilling came into prominence in the present century, and to-day it is the most important method used in the search for oil.

In the earlier rotary wells, cuttings were removed from the bottom of the hole by forcing a stream of water down the inside of the drill-pipe and up the annular space between the pipe and the walls of the hole. In clay or shale strata this water became very muddy, and it was found that the mud-laden fluid had many advantages over clean water. It is now recognised that the nature of this drilling mud has an important bearing on the success attending drilling operations in difficult territory. An appreciation of its functions is reached by a consideration of the work it has to do. This consists, principally, of the removal of cuttings, of the building up of the walls of the hole and the prevention of caving, and of the control of high- and low-pressure sands.

The properties of the mud employed has to be regulated to carry out one or several of these functions satisfactorily; it is often necessary to compromise, as a mud which is excellent for some of these purposes is unsatisfactory for others.

The material for forming the mud is often obtained from the clay and shale penetrated in the actual drilling, but it is now more usual to supply several wells from a central mud-plant. Such a plant is described.

Alluvial clays, where available, are often excellent for mud-making, but the bulk of the prime material used consists of Tertiary, or even older shales and clays. Where heavy muds are required, hæmatite and barytes are added, and various chemicals, notably alkalies, are used to modify the properties of the mud. Occasionally, it is thickened with sawdust or cheap organic refuse, and bentonite derivatives are often added to improve the quality of hæmatite or barytes muds. Careful laboratory control is necessary in the preparation of these artificial muds.

Most central mud-plants are fitted to recondition used muds by the removal of sand, salt water and gas.

The mud fluid must be varied according to the nature of the difficulties anticipated or encountered, and it has been found convenient to record some or all of the following properties: Specific Gravity; Viscosity; Stability; Sand Content; Salt Content and *p*H Value. Methods are described.

Mud does not obey Poiseuille's law, and the viscosity of mud-fluid must be regarded as a variable which cannot be represented by a single figure. It is possible, however, to define a mud fairly well by quoting "yield value" and "mobility." The "yield value" gives a measure of the force needed to start the mud moving, and the "mobility" indicates the extra force needed to produce more rapid motion.

The effect of temperature change on viscosity varies with individual muds; prolonged agitation increases it; chemical reagents increase or decrease it.

Some muds are *thixotropic*—that is, they set to a jelly-like mass on standing, but return to a mobile liquid when agitated.

In the chemical treatment of muds the reagents most used are caustic soda, sodium salts of weak acids and alkaline vegetable extracts. They act as deflocculating agents and modify, principally, the viscosity, stability and plastering power.

Unknown eight or nine years ago, the chemical treatment of mud is now an established practice wherever drilling conditions are difficult. The production of suitable mud and its control call for the closest collaboration between driller, engineer, chemist and geologist. L. O.

622.245.33

496. Geology, Chemistry and Petroleum Engineering Play Important Parts in Drilling Mud Control. M. T. Halbouty. *Oil Weekly*, 9.3.36, **80** (13), 19.—The important theoretical and practical factors governing the control of mud fluids in any drilled hole are referred to. Upon supervision and control of the mud fluid may depend the failure or success of the hole. It is now common practice to put an engineer in charge of mud control.

Chemical treatment of fluids to overcome a number of problems is growing and a knowledge of the formations encountered will assist in determining whether or not certain zones would aid or hinder the control of the mud. L. V. W. C.

622.245.33

499. Lost Circulation in Rotary Holes. W. A. Sawdon. *Petr. Eng.*, Feb. 1936, **7** (5), 27.—Regaining lost circulation in drilling wells is now more possible as a result of extensive research work and the knowledge gained through practical experience.

By the use of colloidal materials many cases of partially or totally lost circulation have been overcome. The addition of fibrous material to the drilling mud has permitted the successful regaining of circulation in a number of instances and "thirsty" formations have been sealed by the use of cement in conjunction with the drilling fluid.

Chemicals have been used with success. The usual method is the introduction of one chemical into the circulating fluid and then another that will cause a precipitation. An impervious plaster on the porous face of the formation is thus produced.

L. V. W. C.

622.243.3

500. Controlled Directional Well-Drilling and Surveying Practice. Part VII. J. D. Hughes. *Petr. Eng.*, Feb. 1936, **7** (5), 59.—Approximately 10% of the total deflecting work in the Gulf Coast is that of crossing faults. The speed of progress in this type of work depends a great deal on the horizontal angle at which the directed hole attacks the fault plane. Where the hole is sliding to the right, a disc bit may be successful in penetrating the fault plane.

A number of plates are given to show the courses of various holes deflecting to cross faults, etc.

L. V. W. C.

622.243.3

501. Theoretical Examination of Straight-Hole and Directed-Drilling Technique. L. V. W. Clark. *J.I.P.T.*, 1936, **22**, 140–165.—The technique of straight-hole and directed drilling is examined from a theoretical standpoint and conclusions are given on the effect of the various factors that may occur in this problem.

G. R. N.

622.243.5

502. Service of Rig Chains and Lines. B. Mills. *Oil Weekly*, 9.3.36, **80** (13), 21.—An analysis of several phases of operation of drilling equipment is being undertaken and research is being directed chiefly towards determining the reasons for untimely failures.

Considerable time has been given to an analysis of the performance of rotary chain and drilling lines that suffer both from neglect and operation beyond their safe capacities.

Lack of lubrication is a fruitful source of breakage of rotary chain, and excessive wear at high speeds has been eliminated by lubricating at predetermined periods. A new type chain lubricator consisting of an 8-ft. section of 4-in. pipe placed horizontally across the top of the draw-works has been developed. The pipe section serves as a reservoir for the light lubricating oil that is used.

The large number of lines between the crown block and travelling block has increased the number of ton-miles for drilling lines without materially affecting the elapsed time for pulling-out and running-in.

L. V. W. C.

622.243.5

503. Dual Power Rotary Rig. W. C. Lane. *Oil Weekly*, 17.2.36, **80** (10), 26.—A simple flexible and efficient power plant for driving a light rotary drilling rig has been put into operation recently in the Kansas area. In this unit the draw-works is driven by electricity and the slush pumps directly from the diesel engine. Energy for both drives is obtained from a common line shaft coupled to two engines.

By using the two systems of transmission, the high flexibility of the speed and torque control inherent in the variable voltage direct-current drive for operating the draw-works and the high efficiency of the direct-belted drive for operating the pumps are taken advantage of. Losses in the pump motor are eliminated by the direct mechanical drive, as are the losses in the generators and in the drive. The hoisting work is done by compounding the two engines through the medium of the generator and the draw-works motor.

L. V. W. C.

622.24.2

504. Gas Rig Fuel Economy. J. C. Albright. *Oil Weekly*, 2.3.36, **80** (12), 30.—A portable gas-engine-driven drilling rig has made over 9000 ft. of hole without even the need for cleaning sparking-plugs. This has been accomplished by reducing the gas pressure before being drawn into the cylinder through the carburettors at a very low pressure. The gas is reduced from 450 lb. pipe-line pressure to about 25 lb. by means of a reduction unit, and all foreign matter is scrubbed from the fuel at the same time.

The reduction and scrubbing unit is described. L. V. W. C.

628.54 : 622.322

505. Water Disposal Plan. T. H. King. *Oil Weekly*, 17.2.36, **80** (10), 14.—Haphazard methods of disposal of salt water accompanying the crude production in the East Texas field have been abandoned, and a programme has been adopted that will safeguard the various streams within and near the field from pollution.

Initial efforts towards solving the problem of disposing of the collected salt water will involve pumping it into the Woodbine horizon through a key well to be drilled about 3 miles from the oil production area.

A wild-cat well which was a failure has been used as a test well, and more than 100,000 brl. of salt water have been pumped to pits, and an input well will be drilled, into which this water will be pumped. It is confidently expected that the Woodbine water sand will absorb large quantities of water under pressure, and the programme calls for the injection of between 250,000 and 500,000 brl. of water. L. V. W. C.

622.248.2

506. Heaving Shale Drilling Advances. B. Mills. *Oil Weekly*, 16.3.36, **81** (1), 51.—Progress has been made in heaving shale-drilling operations in the Texas area by the Continental Oil Company.

After an intensive investigation of the heaving shale problem, the causes for heaving were found to be: (1) disintegration and swelling of shale due to hydration by water from drilling muds; (2) aggravation of caving and heaving by faulty methods and equipment; (3) action of gas blowing shale into the hole, and (4) movement of shale caused by weight of overlying formations. These causes having been recognized, the first move was to prevent hydration. Sodium silicate drilling muds were used to cause sealing of the shale against penetration by water. For the second cause the drill-pipe was replaced by casing and a collapsible wire-line bit was used. This prevented changes in pressure and agitation resulting from pulling-out and running-in drill-pipe. L. V. W. C.

622.4 : 608.3

507. Patents on Drilling Plant. W. H. McKissick. U.S.P. 2,031,056, 18.2.36. A tubing catcher containing a set of slips to engage the casing in which the catcher is lowered. A spring-loaded weight acts on a wedge portion, effecting movement of the locking springs into gripping engagement with the casing.

J. D. Spalding. U.S.P. 2,031,337, 18.2.36. A rotary swivel.

E. D. McFadden. U.S.P. 2,031,613, 25.2.36. A well packer containing an expandible packing element mounted in a housing and means for expanding this element against a well casing.

J. H. Howard. U.S.P. 2,031,654, 25.3.36. A well-tubing support including a well casing and a casing head in which a bushing is placed in a tapered seating to support the tubing.

W. L. Church. U.S.P. 2,031,931, 25.2.36. A well-drilling apparatus consisting of a pipe holder formed of sections hinged together at one side and open at the outer side, the upper end of the holder having ratchet teeth.

C. C. Brown, S. N. van Wert, and A. Aruntunoff. U.S.P. 2,032,000, 25.2.26. A submergible electrically driven reciprocating pump for oil wells.

L. A. Larson and A. Soll. U.S.P. 2,032,423, 3.3.36. A core drill containing a telescoping core tube. This tube extends as the core enters. L. V. W. C.

Production.

622.276.4

508. Safety of Water-flooding Pressures. F. G. Clapp. *Petr. World*, 1935, **32**, 301–304, 328–331; 1936, **33**, 22–27, 31–34.—The properties involved in the problem reviewed are located in the Bradford field, McKean County, Pennsylvania. A large number of wells were abandoned during early years of development, but operations have been revived by the Petroleum Reclamation Company, which is reclaiming the field by the water-flooding process. The system used is locally known as the "five-spot" process, by means of which water under abnormal pressure is forced down intake wells at all corners of a square and the crude is recovered in due course from an oil well at the centre. Since the entire production area is covered with a pattern of such wells, it is evident that the "pay" zones in the Bradford sand become saturated with water at increasingly high abnormal pressures varying in accordance with the intake pressures.

The question placed before the author in the summer of 1932 was whether any danger might ensue from loss of oil or destruction of strata or properties owing to excessive pressures transmitted against the roof of the sand by means of intake flooding. Some of the criteria considered were earthquakes, gas and volcanic blow-outs, surface subsidence, salt-dome mechanics, hydrostatic conditions in known aquifers, formulas for the strength of materials, etc. The answer at that time, after approaching the problem in various ways, was that no danger would result up to an intake pressure of about 3000 lb. per sq. inch and probably much higher. Although time is not available to bring the researches thoroughly up to date or to carry any research to its ultimate conclusion, the results of the original work are given for such interest as they may hold for a petroleum geologist. It is hoped the several branches of study will be carried forward by other persons. W. W.

622.245.4

509. Acidising Upper Limestone Formation Facilitated by the Use of Jelly Seal. L. G. E. Bignell. *Oil & Gas J.*, 5.3.36, **34** (42), 30.—A process has been developed for sealing off a sand formation below a lime-producing horizon in order to allow the latter to be acidized. The pores of the sand are sealed with a jelly, thus preventing loss of the acid into the sand which would otherwise occur when it was run into the lime horizon. The jelly used consists of 3% of organic matter and 97% water, which gives to a semi-fluid mixture, setting when subjected to the heat underground. It may be broken up by the introduction of a culture of bacteria which attacks and devours the organic matter within 24–96 hrs. In addition to temporarily sealing a lower producing sand member of a formation, the jelly seal can be used for testing permeability of a section, for sealing a section of the hole while a cement job is being done, or for sealing off a water formation above an oil sand by running the jelly seal to the bottom of the hole and above, precipitating the soap mixture to plug off the pores of the water formation. An actual sealing test on a sand formation below a limestone horizon, together with acidizing treatment, gave an increased production from 40 brl. per hour to 175·19 brl., an offset well treated with acid only, giving no improvement.

Permeability tests are made by sealing the lower portion of the hole with jelly, pumping gas or fluid into the hole and measuring its entrance with permeable formations. The operation is repeated, the seal being set at higher levels in the structure.

The jelly seal has the characteristic of not taking up further water after setting unless it is vigorously agitated. For a cement job it is possible to run a plug of filler *B* and protect a porous formation long enough to permit the cement to be set and drilled out, and the jelly will then return to liquid conditions, when the sealed formation can be again opened. C. L. G.

622.276.95

510. Gas Repressuring in Eastern Kansas. N. M. Hutchinson. *Oil Weekly*, 24.2.36, **80** (11), 46.—This article reviews the results obtained by repressuring the Bartlesville sand and the Madison Block, Kansas using natural gas. Curves are given to show the increase in production resulting from the repressuring operations. L. V. W. C.

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622.276.96

511. Systematic Programme is Essential in the Proper Application of Repressuring. C. B. McClintock. *Oil & Gas J.*, 23.1.36, **34** (36), 24.—Among the new phases and improvements in the development of repressuring and flooding may be quoted (*a*) coring of wells, (*b*) core analysis, (*c*) packer application, (*d*) pattern drilling, etc.

Before commencing a repressuring project it is necessary to core several wells across the property to enable a determination of the best section on which to start the development work. Representative samples are tested for porosity, saturation, permeability, etc.

Packers are set in the intake wells after the wells have been tested for pressure and volume. A pressure-volume testing string is run, and the pressure necessary to force a given volume of gas or air–gas into various sections of the sand during a certain period of time is determined.

The use of pattern drilling permits a better control of the repressuring medium. Air is most usually used as the repressuring medium, but gas is used wherever possible. The air–gas mixture which results is tested periodically for percentage air content, which is not permitted to exceed 75 per cent.

All gas-injection volumes are measured, and producing wells are also equipped with orifice flanges, and periodic tests of the flow of gas from these wells are made to determine the oil–gas ratio. L. V. W. C.

622.276

512. Flow of Oil–Gas Mixtures in the Tubing of a Well. B. H. Sage and W. N. Lacey. *A.P.I. Prod. Bull.*, Nov. 1935 (216), 50.—Thermodynamic diagrams are presented for several mixtures of the oil and gas produced from a flowing well in Dominguez field. Methods of evaluating energy quantities involved in the flowing process are discussed in some detail. For flow at the rate of 120 brl./day from well bottom to surface in the well from which the samples were taken, the heat loss to the surroundings aggregated 32·5 B.Th.U./lb. of flowing mixture, the energy involved in frictional effects was 2·4 B.Th.U., whilst the energy required for elevating the material was 7·2 B.Th.U./lb. The specific volume of the mixture and its average velocity are given as functions of the depth below the surface. W. W.

622.323: 531.787

513. Recording Subsurface Pressure Gauge. Anon. *Petr. World*, 1936, **33**, 3–5.—Presents briefly the part which the Bureau of Mines has played in the development of suitable instruments for the measurement of subsurface pressures and temperatures in producing oil and gas wells, and describes a new recording subsurface pressure gauge which has been in use during the past year by Bureau of Mines Engineers. W. W.

622.276.4

514. Water Flooding of Oil Sands. C. B. McClintock. *Oil & Gas J.*, 30.1.36, **34** (37), 56.—In water-flooding projects no definite well spacing is used between water and oil wells, the spacing being governed by the core analysis and past operating experience.

Three recovery methods are in use, artificial water flood, delayed drilling and flowing, and these are briefly explained. The water used in flooding the oil sand is filtered to prevent plugging of the sand. L. V. W. C.

553.982

515. Saturation of Oil Sands. J. H. Gardner. *Oil & Gas J.*, 6.2.36, **34** (28), 15.—Two distinct types of saturation in a sand exist, saturation and super-saturation. Saturation applies to the oil content of the sand after all the free oil has been removed, and super-saturation refers to the oil that has been removed by flowing, pumping and reclaiming. One type is held tightly and the other is free moving. Some interesting results may be observed with regard to this free-moving mechanism. It is the super-saturated oil sand that produces oil, and the fluid with which the sand is super-saturated is the fluid produced, whether this is oil or salt water. L. V. W. C.

622.245.49

518. **Sealing-off Salt Water from Oil-bearing Formations.** L. G. E. Bignell. *Oil & Gas J.*, 30.1.36, **34** (37), 59.—A new method of shutting off formation water consists in injecting acid into oil-filled pores together with a patented soap solution and other ingredients to give body and gumminess to the mixture when it mingles with salt water. Calcium and magnesium are precipitated, forming a satisfactory seal and retarding water movements. L. V. W. C.

552.1 : 620.16

517. **Determination of Apparent Volume and of the Volume of Voids.** J. P. Buwalda. *J.I.P.T.*, 1936, **22**, 177–179.—A description of a portable apparatus suitable for determining the apparent total volume and volume of the voids in samples of stones. G. R. N.

622.276: 622.323(766)

518. **Present Production Methods—Oklahoma City Field.** F. A. Lichtenheld. *Oil Weekly*, 24.2.36, **80** (11), 42.—The Oklahoma City field is a proving ground of production practices for wells of 6500 ft. in depth, and six different methods are being employed successfully within that area. These may be listed as: (1) natural flow, (2) gas lift and various gas-lift devices, (3) electrical submerged centrifugal pumps, (4) pneumatic pumping cylinder, (5) walking beam and (6) hydraulic submerged pump. Each of these methods is dealt with briefly. L. V. W. C.

622.276.4

519. **Four-Well Pump Hook-Up.** E. S. Post. *Oil Weekly*, 23.3.36, **81** (2), 42.—A four-well pumping arrangement for a shallow lease has recently been put into use. The four wells are placed 150 ft. each way out from the corners of the lease, and the power is constructed midway between wells Nos. 2 and 3. The pull for these wells is on opposite sides of the power, and the power for Nos. 1 and 4 is provided by running the shackle lines to swings set at wells Nos. 2 and 3. Due to the excellent balance of these wells, a six-horse-power engine is sufficient to pull all four 725-ft. wells at one time. L. V. W. C.

622.276.4

520. **Pumping Equipment on Prorated Wells.** V. D. Bennett. *Oil & Gas J.*, 27.2.36, **34** (41), 31A.—Proration of daily production has resulted in wells being equipped with surface pumping machinery of horse-power capacity commensurate with the reduced requirements. Excessive horse-power capacity on pumping rigs has been eliminated.

The general practice is to drill to the top of the producing formation with the rotary system, and then to drill-in with a portable cable-tool unit. On the completion of the well, tubing and rods are run, and a pumping potential is taken before moving the portable unit from the location.

Where portable well servicing is available, the initial investment may be reduced by the use of back-aide cranking equipment, and the prime consideration in the choice of pumping equipment of this type is its capacity. Where dynamometer readings are taken for determining the actual well loads, the correct pumping equipment can be accurately and intelligently selected. Where these are not taken, a formula can be used to determine the loads, and the estimated horse-power requirements can be determined by another formula. L. V. W. C.

622.276.4

521. **Modern Pumping Equipment Covers Wide Range for Many Applications.** M. L. Haids. *Oil & Gas J.*, 27.2.36, **34** (41), 64A.—This is a very comprehensive article on the various available methods for producing oil by artificial means. Beam pumping, gear reduction pumping and bandwheel pumping are considered, together with a number of bottom-hole pumps, intermittent gas-lift devices, plunger-lift devices and electrical submergible pumps. L. V. W. C.

621.65: 622.276.4

522. New Submergible Type Oil-well Pump. Anon. *Oil & Gas J.*, 27.2.36, **34** (41), 96A.—A pump of the reciprocating type but powered with several vertical, polyphase, induction motors coupled together, to generate power to activate the sucker rods placed between the power and the working barrel at the bottom of the hole, has recently been placed on the market.

The motors operate in parallel, and the rotating movement of the motors is converted into reciprocating motion by means of an automatic mechanism. A shuttle is adapted to move axially with a reciprocating movement along a double-threaded helix worm-shaft and a double-acting working barrel is connected to the upper end by means of connecting-rods. L. V. W. C.

621.65: 622.276.4

523. Sucker Rod Breakage can be Reduced by Use of Proper Design and Metal. A. Allen. *Oil & Gas J.*, 27.2.36, **34** (41), 72A.—The proper selection of sucker rods for a particular duty has shown that the rods will not fail excessively, and will materially reduce lifting costs. Several different types of rods are needed, and these must be designed for wells of the following types: (1) common rod for sweet oil only, (2) mild corrosion, medium weight, (3) extra strong for sweet oil only, (4) mild hydrogen sulphide and (5) bad hydrogen sulphide.

Each well is an individual study, the amount of corrosion, the load and other factors affecting the choice of the proper type of sucker-rod steel.

Breakages have been reduced considerably by proper care of the rods and the correct selection for the well in question. L. V. W. C.

622.323: 66.069.84

524. Stage Separation of Oil–Gas Mixtures. R. L. Huntington. *Refiner*, 1936, **15** (2), 65–67.—After shortly discussing the separation of gas from crude oil flowing from producing wells and graphically indicating that, in general, there is little advantage in separating this mixture after the second stage, the author concludes that some advantages of stage separation are: (1) the investment in field lines and compressor equipment can be materially reduced as a result of the retention of back pressure on the field separators, (2) the use of gas lift has resulted in the production of more natural gasoline per brl. of crude oil, due to the stripping action of the gas on the crude oil itself, (3) the holding of back pressure on the separators has caused a marked decrease in the entrainment of oil mist into the gas-gathering lines going to the natural gasoline plants. Some disadvantages of stage separation are: (1) the gasoline plant must instal high- and low-pressure gathering systems in order to process the gas produced from both the high- and low-pressure separators. (2) Stage separation in itself does tend to decrease the amount of natural gasoline produced per brl. of crude oil, since the approach towards differential liberation of gas tends to hold a higher percentage of the natural gasoline constituents in the crude oil. G. R. N.

Pipe-Lines.

622.698: 620.197

525. Wind-Powered Generators for Cathodic Protection of Pipe-lines. F. H. Love. *Petr. Eng.*, Feb. 1936, **7** (5), 31.—The efficiency and applicability of wind-powered generators for the cathodic protection of pipe-lines have been recently increased by the perfection of an automatic current regulator and improvements enabling the unit to operate on a lower wind velocity than formerly (3–3½ m.p.h. instead of 8 m.p.h.). The units can now operate more than 50% of the time, instead of 30% as before. Operating data are given on a series of generators installed by a gas-supply company, the voltage generated, revolutions per minute, amperage and ground resistance of each unit being given. The section of the line under a 0·8 voltage was found to have been positively protected, and that under 0·65/0·8 partly protected. As a result of these observations the gas company has concluded that the cost per mile of pipe protection could be reduced by (1) installation of units of greater amperage (40 amps.) at an increased cost of $50.00, giving a protection of 1½ miles, (2) shallow ditching and immediate treating with $CaCl_2$ in order to collect water at the point of ground and

pipe contact, and thus increase ground resistance, and (3) reduction of ground bed from 400 to 300 ft.

The generator now designed is connected by a 1 : 3½ gear to an airplane type propeller and the whole assembly mounted on a tower 40–60 ft. high. A resistance is placed in series with the field coil of the generator, which is cut in by the opening of two points regulated by the quantity of current passing, thus preventing burning out during excessive wind-speed periods. C. L. G.

622.698 : 620.197.6

526. New Machine to Coat Pipe with Concrete. S. C. Lines. *Pipe Line News*, Feb. 1936, **8** (3), 5.—Describes a machine for extruding an encasement of concrete on pipe used for permanent or semi-permanent pipe-lines subject to soil stresses, corrosion and/or electrolysis. A light steel frame is supported on the pipe by dollies; on the frame a small gasoline engine is mounted which actuates a revolving drum and cone; a housing encompasses the cone, concentric with and surrounding the pipe, with a hopper for receiving the concrete. As the screw on the revolving cone surface forces the concrete from between the outer surface of the pipe and inner surface of the housing, the machine is compelled to yield to the reaction thrust, backing away from the completed coating as it emerges. It is only after the coating has been extruded to a density able to resist the increasing pressure of the machine that motion of the machine is imparted. Hence there is automatic regulation of concrete density. So far as the machine is concerned, it is possible to place several thousand feet continuously and at the rate of 4-ft./min. Good results have been produced with a mix of 1 cement, 1·5 graded sand, 2·5 roofing (pea) gravel and 0·5–0·6 water cement ratio. A minimum of ½ in. and maximum of 2 in. thickness of concrete are indicated as units of machine capacity. In the course of experimentation, coating thicknesses ranging from ¾ to 1¼ in. have been applied. The crew should not exceed five men, the machine itself requiring but one man, his duty being to steady it on the pipe, to see that it moves uniformly and to take care of lubrication, adjustments, etc. W. W.

622.698 : 621.791.7

527. Ingenious Repair Made in Oil Line by Welding. Anon. *Pipe Line News*, Feb. 1936, **8** (3), 9.—The repair described was carried out on an 8-in. high carbon-steel pipe carrying crude oil under a pressure of 900 lb./sq. in., which burst near the bottom of a long upgrade, resulting in a loss of 1500 brl. of oil. Any attempt at welding the break being out of the question at the time the burst occurred, a temporary repair was effected by means of a sleeve clamped over the break with rubber packing-rings to seal off the ends. Owing to there being no opportunity for a shut-down of duration long enough to permit of drainage of the oil, or pumping a water plug, the temporary repair remained in position for 4 years. At the end of this period the rubber in the joints was gradually being forced out between the sleeve clamps and the pipe. A unique "cuff" was therefore designed to cover the sleeve completely, which enabled a repair to be made by welding without shutting down the pumps, draining or reducing the line pressure. The sleeve was made from a short piece of 14-in. pipe with wedges cut from the ends and, using a spare joint of 8-in. pipe—with a sleeve similar to the one used in making the emergency repair—as a mandrel, the 14-in. pipe was blocked in place and the ends were swaged down to contact the 8-in. pipe. The swaged ends were then welded with oxy-acetylene kit, and the completed shell was split longitudinally in halves with the cutting torch. Two 4-in. collars were then welded into the upper section to serve as risers. The two halves of the "cuff" were then clamped around the emergency sleeve of the main line, joined together again, and swaged ends welded to the main line by means of a portable arc-welding set using ⅛-in. shielded-arc rod. The space between "cuff" and sleeve was filled with grout, introduced through the 4-in. risers, thus holding the original repair sleeve firmly in a matrix. Bull plugs were then screwed into the risers and welded in position. W. W.

622.698 : 620.197

528. Electrical Instruments Applied to the Study of Pipe-Line Corrosion. J. M. Pearson. *A.P.I. Prod. Bull.*, Nov. 1935 (216), 75.—The precision and reproductibility of electrolysis measurements can be brought up to good engineering standards

by the use of certain instrument refinements. By suitable correlation of simultaneous readings, stray current circuits can be traced and quantitatively closed. By measurement of the constants of the network carrying the offending currents, additional members of the network can be designed to redistribute the current flow in such a way that most hazards can be eliminated. In some cases positive cathodic protection can be obtained, if desired. Effects of drainage on other structures can be calculated and the structures suitably protected. Quantitative measurements of results obtainable by a given remedial measure can be made. W. W.

622.698 : 620.197

529. Soil Corrosion. J. F. Putnam. *A.P.I. Prod. Bull.*, Nov. 1935 (216), 66.—The general principles of soil corrosion are outlined, and a differentiation is made between acid and alkaline soils—giving, it is believed, a method of predetermining soil corrosivity which will apply to all soils. Equations are derived from the National Bureau of Standards data showing how corrosion weight loss and rate of pitting vary with time. A correlation of the National Bureau of Standards soil-corrosion data with soil tests is made. From these data expressed in curve form and the practical experience of a large pipe-line operator, a method is given for computing the time to the first leak. W. W.

622.698 : 621.89

530. Pump Lubrication. E. Sterrett. *Refiner*, 1936, **15** (2), 81–82.—As a result of a check up on the volume of lubricating oil used in a main-line pumping station, it was found that the lubricating device on the gear-driven pump cross heads was only 58% efficient in supplying oil to the upper shoe. This low efficiency resulted in a waste of 54·9 galls. of lubricating oil out of 90 galls. per month used in this station. By moving the lubricator to a predetermined point nearer the crank the waste was decreased to 25 galls./month. This waste was practically eliminated and the lubricating consumption cut down from 90 to 24 galls./month by fixing copper scoops at both ends of the cross-head shoe in such positions that the oil collected flushed into the space between the shoe and the slide. G. R. N.

Transport.

629.123.24

531. Development and History of the Tank Ship. B. O. Lisle. *J.I.P.T.*, 1936, **22**, 118–139.—A complete and illustrated account of the history and development of the tanker. G. R. N.

629.123.24 : 621.436

532. Care and Maintenance of a Modern Diesel-Engined Tanker Fleet. H. S. Humphreys. *J. Inst. Mar. Eng.*, 1936, **48**, 1–22.—This paper deals first with tanker construction, with special consideration of the problems arising from the transport of dangerous liquids, and secondly with diesel-engine maintenance, and a review of the present trend of design. The article is profusely illustrated. C. H. S.

Storage.

621.642.3: 553.982

533. Shell's Brooklyn Terminal. J. W. Thompson. *Nat. Petr. News*, 26.2.36, **28** (9), 44.—The large terminal of the Shell Eastern Petroleum Products, Inc., at Brooklyn, New York, is described. The plant has a storage capacity of over 1,000,000 galls., split up into forty tanks of 27,000 galls. each. The entire tankage is underground. W. W.

621.642.3: 553.982

534. Losses of Petroleum Products Stored in Ponds. Gluzdenok. *Neft.*, 1934, **5** (15), 19–21.—In order to establish losses through evaporation and seepage of oil products through the soil in ponds, crude oil was stored in specially prepared ponds

covered with a roof protected with roofing paper. It was found that the evaporation losses are negligible, whilst losses through seepage after 18 days are in direct proportion to the column of the liquid. The nature of the crude oil appears to be of no importance. The losses can be lowered by storing the crude oil on a cushion of water, since in this case only the penetration of the oil through the side walls must be considered.
For. Petr. Techn.

621.642.34

535. Moving a Petrol Storage Tank. Anon. *Engineer*, 1936, **161**, 259.—An article in *Engineering News Record* describes the moving of a petrol storage tank 40 ft. in diameter by 35 ft. high to a new site 150 ft. away, having foundations 9 ins. higher. The moving was done by the flotation method. W. W.

Gas.

614.83

536. Device gives Protection from Inflammable Gas Explosions. Anon. *Oil & Gas J.*, 13.2.36, **34** (39), 40.—A description is given of the J-W combustible gas alarm, which continuously analyses the air at any desired point and indicates at all times the amount of any inflammable gas that may be present. If the concentration of the gas rises so high that the resulting gas becomes combustible or explosive, the instrument can sound an alarm or start up ventilating apparatus or other protective equipment. The principle of the instrument is the change in electrical resistance of an incandescent filament over which the air being controlled is drawn, giving a rise in temperature when inflammable gas is present. Electrical contacts are closed when the intrument dial-reading reaches a predetermined figure, putting into operation any desired protective equipment. C. L. G.

66.074.37: 608.3

537. Patents on Gas. H. Koppers' Industrielle Maats., N.V. E.P. 443,407, 27.2.36. Removal of hydrogen sulphide and other sulphur compounds from gases, especially from coal-distillation gases, by means of an alkaline washing solution containing compounds of the tin group in qualitative analysis, *e.g.* Sulphur–arsenic–oxygen compounds and a small quantity of manganese and/or copper compounds.

Chem. Construction Corpn. and J. M. Rumple. E.P. 443,452, 28.2.36. Production of sulphur dioxide from acid sludge obtained in the refining of carbonaceous material and of petroleum hydrocarbons. The sludge is contacted with a stream of highly-heated non-gaseous medium consisting of metal balls in order to decompose it to form a carbonaceous residue with evolution of sulphur dioxide free from hydrogen sulphide. The sulphur dioxide is removed continuously from the reaction zone; the carbonaceous material and metal balls are also removed continuously. W. S. E. C.

66.074.37 : 608.3

Gas Light & Coke Co., K. Hutchison and G. U. Hopton. E.P. 443,094, 18.2.36. Removal of oil-soluble sulphur compounds from gases, *e.g.* carbon bisulphide and thiophen compounds, by treating the gases with wash oil in quantities of 20–40 gallons/1,000 c. ft. of gas. The wash oil is regenerated or stripped from sulphur compounds by distillation with direct steam at pressures below atmospheric and at a temperature of 70–75° C. The hot stripped oil leaving the stripping still is employed for preheating the wash oil passing from the gas scrubber to the stripping still. W. S. E. C.

Crude Petroleum.

665.51: 532.13

538. Viscosity of Hydrocarbon Solutions. B. H. Sage, J. E. Sherborne and W. N. Lacey. *A.P.I. Prod. Bull.*, Nov. 1935 (216), 40.—A marked decrease in viscosity occurs when hydrocarbon gases are dissolved in petroleum oils. These changes are important factors in the recovery of crude petroleum from underground pools. Viscosity values are given for solutions of ethane and *n*-butane in a water-white refined fraction of Western crude stock known as "crystal oil." The paper also presents a

comparison of the effects of each of four separate gases on the viscosity of crystal oil. Apparatus and method used in the determination of the viscosity of the saturated solutions are briefly described. W. W.

66.074: 665.51: 608.3

539. Patents on Crude Oil. C. L. Smith and W. G. Annable. U.S.P. 2,032,896, 3.3.36. Fractional distillation and desulphurising of crude oil by heating the oil to vaporize without substantial cracking and contacting the vapours with a treating agent, *e.g.* copper oxide to combine with the sulphur. Fresh quantities of copper oxide are added as required, and the spent oxide is withdrawn and regenerated for re-use.

66.066: 608.3

M. De Groote *et alia*, U.S.P. 2,034,941, 24.3.36. Separation of oil–water emulsions by subjecting them to the action of a demulsifying agent prepared by blowing ricinoleic acid using an oxygen-containing medium, diluting with an equal of kerosene and neutralising the free acidic hydrogen with triethanolamine.

665.52: 608.3

G. B. Coubrough. U.S.P. 2,035,945, 31.3.36. Fractionation of unbalanced crude containing only 5% of gasoline and 45% of asphalt by mixing with an unbalanced crude containing 40% of gasoline. The mixture is heated, the gasoline, kerosene and gas are vaporized, leaving a lubricating stock and asphalt residue. The vapours are fractionated to obtain a diluent product of narrow boiling range at least as light as gas-oil, which is mixed with the residue, and the mixture heated. The lubricating oil stock is vaporized, the diluent removed and cycled to add to the crude.

66.066: 608.3

C. N. Stehr. U.S.P. 2,034,963, 24.3.36. Breaking of oil-water emulsions by the action of a demulsifying agent consisting of a blend of the following products obtained from castor oil: (1) 15–50% of fatty bodies, (2) 2–15% of acid salts of sulpho-fatty acids, (3) 20–60% of unsaponified sulphur-free fatty acid obtained by sulphonation and hydrolysis of products from castor oil, (4) 5–25% of an aliphatic monohydric alcohol having at least 3 carbon atoms and (5) kerosene. W. S. E. C.

Physical Chemistry.

535.34: 547.672.1

540. Infra Red Absorption Spectra of some Anthracenic Hydrocarbons. P. Lambert and J. Lecomte. *Ann. des Comb. Liq.*, 1935, **6**, 1077–1091.— In the present work, four hydrocarbons were investigated, using the author's method described in *Ann. Comb. Liq.*, 1934, **6**, 979–993 and 1001–1089, with an improved method of mounting the cell *in vacuo* to insulate against shock. The results of the present work confirm the conclusions expressed in the earlier publications—namely, that infra-red absorption spectra follow very closely changes in chemical structure. The authors consider that certain theoretical principles can be applied qualitatively to the problem of determining the composition of organic substances with particular reference to the hydrocarbons occurring in lubricating-oil fractions of petroleum.

By way of illustration the three types of vibration in anthracenic hydrocarbons are discussed. J. L. T.

536.66: 547.313: 542.941

541. Heats of Organic Reactions. III. Hydrogenation of some Higher Olefins. G. B. Kistiakowsky, J. R. Ruhoff, H. A. Smith and W. E. Vaughan. *J.A.C.S.*, 1936, **58**, 137–145.—A careful re-check of the accuracy of the method used by these workers for the determination of gaseous reaction heats has been made. This work substantiated earlier conclusions regarding the accuracy of the results. In the present paper heats of hydrogenation of the following olefins were determined at 355° K., viz.: *n*-heptene-1, *unsym.*-methylethylethylene, *cis-* and *trans*-pentene-2, *unsym.* methyl*iso*propylethylene, *cyclo*hexene, trimethylethylene and tetramethylethylene.

The results, expressed as ΔH cals./mole, varied from − 30,137 for *n*-heptene-1 to − 26,633 for tetramethylethylene. The results to date by these workers allow some generalizations to be made. It appears that with increasing number of substituent alkyl groups the heat of hydrogenation is lowered in a progressive manner. Thus mono-, di-, tri- or tetra-substitution causes a decrease of 2·7, 4·2–5·2, 5·9 and 6·2 Cals. respectively. The differential effect decreases with increasing number of substituents. The effect is independent of the chain length of the normal alkyl radical substituted, but branched groups appear to have greater influence. W. E. J. B.

536.66: 547.315: 542.941

542. Heats of Organic Reactions. IV. Hydrogenation of some Dienes and of Benzene. G. B. Kistiakowsky, J. R. Ruhoff, H. A. Smith and W. E. Vaughan. *J.A.C.S.*, 1936, **58**, 146–154.—Similar to preceding abstract. The following values for ΔH cal./mol. at 355° K. were obtained:

Allene + $2H_2$	− 71,280
1 : 3-Butadiene + $2H_2$	− 57,067
1 : 4-Pentadiene + $2H_2$	− 60,790
1 : 5-Hexadiene + $2H_2$	− 60,525
1 : 3-*cyclo*Hexadiene + $2H_2$	− 55,367
Benzene + $3H_2$	− 49,802
*cyclo*Pentadiene + $2H_2$	− 50,865

W. E. J. B.

541.25: 547.21

543. Method for Comparison and Analysis of Physical Properties of Homologues and Isomers. The Molecular Volume of Alkanes. G. Calingaert and J. W. Hladky. *J.A.C.S.*, 1936, **58**, 153–157.—This paper describes a graphical method for evaluating the reliability of physical data and studying the effects on the data of constitutional changes in the molecule.

The method is illustrated by considering the molecular volume of the alkanes, and from the graphical scheme developed some interesting trends of structural effects on molecular volume are noted, as well as some inaccuracies in the literature which the scheme has revealed. Further, the range C_9 to C_{12} requires additional data, as yet not to be found in the literature. The scheme used is not limited to one group of compounds nor to the property used in the illustration. The only requisite is that the property under review shall be accurately known for one series of compounds in the class to be investigated. W. E. J. B.

547.313.4: 536.75

544. Heat Capacity, Entropy and Free Energy Data for the Isomeric Butenes. S. S. Todd and G. S. Parks. *J.A.C.S.*, 1936, **58**, 134–137.—The heat capacities of the four isomeric butenes have been measured between liquid air temperatures and their respective boiling points, and from this and other data the entropies and the free energies of formation have been calculated. The data found are given below, viz. $S°_{298}$, total entropy in calories per degree per mole and $\Delta F°_{298}$, molal free energy in calories.

Hydrocarbon.	$S°_{298}$.	$\Delta F°_{298}$.
Butene-1 (g.)	72·5 e.u.	16,780 cals.
cis-Butene-2 (g.)	73 ,,	14,860 ,,
trans-Butene 2 (g.)	71·2 ,,	14,450 ,,
*iso*Butene (g.)	69·0 ,,	14,240 ,,

W. E. J. B.

537.226

545. Liquid Dielectrics. J. D. Piper, D. E. F. Thomas and C. C. Smith. *Ind. Eng. Chem.*, 1936, **28** (3), 309.—Power factor and conductivity measurements have been

made in liquid paraffin containing various concentrations of nine compounds. The liquid paraffin was a water-white oil of 285 Saybolt Universal seconds viscosity at 40° C., and 50·5 Saybolt Universal seconds at 100° C., and was chosen because of its comparative freedom from traces of oxidation products and colloidal materials. The nine compounds selected were: stearic acid, mixed naphthenic acids, propionic acid, valeraldehyde, heptaldehyde, methyl-*n*-amyl ketone, cetyl alcohol, cetyl acetate and benzoyl peroxide. Power factors and conductivity measurements were made on each sample of base oil alone and again after addition of the compound. The concentrations of the compounds used were selected to cover more than the range of the total concentration of oxidation products encountered in service-aged mineral insulating oils, especially high-voltage underground cable oils. While in homogeneous solution in the oil, none of the selected nine compounds in reasonable concentrations caused sufficiently large increases in the power factor and the conductivity of the oil to be considered of any practical significance in high-voltage cables. On separating from solutions as a soft gel, one of the compounds, cetyl alcohol, produced a power factor many times greater than that of the oil. H. E. T.

545.81: 66

546. Measurement of Colour in Fats, Oils, and Waxes. L. Ivanovszky. *Ole, Fette, Wachse*, 1936, No. 4, p. 1.—A description of the theory, construction and scope of various colorimeters and photometers which are suitable for measurements on oils, fats and waxes. P. G. H.

Chemistry of Petroleum.

542.944: 547.21

547. Chlorination of Paraffins. H. B. Hass, E. T. McBee and P. Weber. *Ind. Eng. Chem.*, 1936, **28** (3), 333.—A method is proposed for calculating from the structural formula of any paraffin hydrocarbon the percentages of its various isomeric monochlorides obtainable by non-catalytic chlorination at temperatures ranging from − 65° to + 600° C. The effect of temperature, liquid-phase reaction, vapour-phase reaction, light, carbon surfaces, reaction rate, excess of hydrocarbon, and structure of hydrocarbon, on the isomeric ratios has been studied. For the quantitative prediction of the proportions of isomeric dichlorides obtained no method has been evolved. In vapour-phase chlorination there is a tendency which minimizes the yields of dihalides containing two chlorine atoms on the same carbon atom. Henfelder's rule to the effect that the only dihalides formed are those containing halogen atoms attached to adjacent carbon atoms, does not apply to chlorinations where all isomerides derivable without carbon skeleton rearrangement are always formed. The paper gives a fairly comprehensive account of the chlorination of simple paraffins. H. E. T.

66.094.37

548. Vapour-Phase Catalytic Oxidation of Organic Compounds. W. G. Parks and J. Katz. *Ind. Eng. Chem.*, 1936, **28** (3), 319.—The catalytic activity of various mixtures and compounds has been investigated in the vapour-phase oxidation of toluene to produce benzaldehyde and benzoic acid. Among the various catalysts employed may be mentioned, compounds of vanadium, molybdenum, uranium, tungsten, lead, chromium, silver, tantalum, columbium and boron. The catalysts were prepared as described by Mellor, such substances as granular aluminium, pumice, asbestos and alumina being used as supports. The results obtained on sixteen catalysts which showed the greatest effect are reported. With each catalyst, the temperature, concentration of vapour and time of contact were varied over a wide range. The best results were obtained with a catalyst consisting of a mixture of uranyl molybdate and boron carbide and a temperature of 575° C., the conditions being, space velocity (primary air) 420, space velocity (secondary air) 1010, air–hydrocarbon ratio 1·38 by weight, and volume of catalyst 19·3 c.c. The yield of benzaldehyde on the basis of toluene was 20 per cent. per pass.

In the light of the results obtained from this investigation a brief discussion is given of the problem. The commercial possibilities of the reaction are discussed, and a simplified commercial unit and method of operation are suggested. H. E. T.

542.958.1: 547.21

549. Nitration of Gaseous Paraffins. H. B. Hass, E. B. Hodge and B. M. Vanderbilt. *Ind. Eng. Chem.*, 1936, **28** (3), 339.—An account is given of the present state of knowledge with regard to the nitration of gaseous paraffins. The authors, for the first time, have nitrated saturated hydrocarbons of less than five carbon atoms, the nitration reactions being effected almost exclusively in the vapour phase. The results obtained during several years of study on the vapour-phase nitrations of paraffins is reviewed; thus, nitromethane, nitroethane, both nitropropanes and all of the four nitrobutanes are readily obtainable. To a large extent the ratios of isomers in the reaction products are controllable. The nitroparaffins thus prepared in the vapour phase are colourless compounds, relatively non-toxic, stable solvents boiling over the range 100°–151° C. Their physical and chemical properties, possible industrial uses and the economics of their production are discussed. H. E. T.

547.217.1: 542.952.1

550. Isomerization of Normal Heptane. G. Calingaert and H. A. Beatty. *J.A.C.S.*, 1936, **58**, 51–54.—This paper describes the products formed by heating *n*-heptane in the presence of aluminium chloride. The latter was added in small portions to boiling *n*-heptane, while lower-boiling products of the reaction (which included isomeric heptanes) were continuously removed through a fractionating column. The low-boiling products so obtained were examined by rigorous fractionation and b. p.'s, refractive indices and critical solution temperatures in aniline were determined. The data indicated the presence of three hexanes, viz. 2- and 3-methylpentane and *n*-hexane, and at least three, and probably five, of the eight branched chain heptanes. The total amount of these hydrocarbons formed represented about 6 and 5% respectively of the reacted *n*-heptane, whilst pentanes and lower represented 64·6% and polymerization products 24·4%. W. E. J. B.

547.314.6

551. Reaction of Butylacetylene with Oxygen. C. A. Young, R. R. Vogt and J. A. Nieuwland. *J.A.C.S.*, 1936, **58**, 55–56.—Butylacetylene which has been carefully purified to remove olefin impurities forms a peroxide which is not formed by a polymer or allene form of the acetylene hydrocarbon. The peroxide is unstable when in concentrated form, and valeric acid has been identified as one of the decomposition products. W. E. J. B.

547.313.4: 547.223.4

552. Solvent Effect in the Addition of Hydrogen Bromide to *Iso*butylene. M. S. Kharasch and W. M. Potts. *J.A.C.S.*, 1936, **58**, 57–59.—Pure tertiary butyl bromide is formed when hydrogen bromide is added *in vacuo* to *iso*butylene in the presence of solvents and anti-oxidants; if the addition is made in the presence of solvents, air, and peroxides, *iso*butyl bromide is formed in amounts varying from 100 to 75%. It thus appears that under rigorous anti-oxidant conditions solvents themselves have no effect on the direction of addition of HBr, but do affect the rate of addition. W. E. J. B.

547.313.4

553. Dibromide Method of Analysis of Butene Mixtures. W. C. Young and S. Winstein. *J.A.C.S.*, 1936, **58**, 102–104.—This article is concerned with substantiating the reaction rate-dibromide method of analysis of butene mixture (Dillon, Young and Lucas, *J.A.C.S.*, 1930, **52**, 1953). A dibromobutane mixture has been distilled at atmospheric pressure without undergoing appreciable change, and it is considered that differences in butene analysis obtained on samples derived from the catalytic decomposition of 1-butanol are due to the effects of the catalyst, temperature, etc., and not to the analytical method. W. E. J. B.

661.716

554. Pressure Pyrolysis of Gaseous Paraffin Hydrocarbons. H. Tropsch, C. L. Thomas and G. Egloff. *Ind. Eng. Chem.*, 1936, **28** (3), 324.—Propane, *n*-butane, *iso*butane

and mixtures containing these gases have been pyrolysed at temperatures ranging from 525° to 575° C., and at 51 kg. per square cm. (725 lb. per square inch) pressure. The gases produced by pyrolysis contained paraffinic hydrocarbons of lower molecular weight than the hydrocarbon under investigation, together with ethylene, propene and butenes. At a sufficiently long contact time a part of the olefins was pyrolysed to liquid products. The liquid yield may be increased by catalytically polymerizing the unreacted olefins; thus it is estimated that 1 cub. m. of butanes would give 1·5 litres of liquid product (11·5 gallons per 1000 cub. ft.), 90% of which is gasoline having an octane number of 77 and a blending value of 73 octane by the C.F.R. motor method. The effect of pressure was investigated, and reactions are proposed to account for the observed results. Under the conditions studied the hydrocarbons decreased in thermal stability in the order propane > *iso*butane > *n*-butane. The gases were analysed in a modified Orsat apparatus, using 93% sulphuric acid for *iso*butene, 87% for propene and *n*-butenes and bromine water for ethylene; the total olefins were checked using a fresh gas sample and bromine water. In the runs with pure propane, *n*-butane and *iso*butane, the condensable and uncondensable gases were analysed by means of the Podbielniak low-temperature distillation method, and the fractions were analysed by the absorption method; thus the amount of each individual gas formed in an experiment was determined. The average molecular weight of the gases was determined by the effusion method using the Schilling apparatus. A formula for the contact time has been developed, assuming that under the conditions employed the perfect gas laws hold. H. E. T.

541.128.24 : 547.592.2

555. The Induction Period in Auto-Oxidation. H. N. Stephens. *J.A.C.S.*, 1936, **58**, 219–224.—This paper is concerned with the autoxidation of *cyclo*hexene at 28° C. Rigorous purification of the hydrocarbon was undertaken, and the results obtained indicated that the "inhibition period" diminished as purification improved, but even the most carefully purified material did not start oxidizing at its maximum rate, *i.e.* the induction period was not eliminated completely. The effect of arsenic trioxide was inhibitory. From other experiments on the effect of water, increased surface, and maximum rate for oxygen absorption, the author concludes that autocatalysis can, at most, play an insignificant part in the early increase in rate of reaction with time. It is suggested that the rate-determining factor is the rate of activation of hydrocarbon molecules, and that this process of activation occurs at the walls of the vessel. The attainment of maximum rate will thus be dependent mainly on the destruction of inhibitors. W. E. J. B.

66.074.37 : 665.51

556. Benzole Purification. Anon. *Chem. Trade J.*, 6.3.36, **98**, 191.—A continuous process for the extraction of sulphur from crude benzoles by physical means has been patented by the Soc. des Établissements Barbet of Paris (E.P. 441,518 of 1935). A fraction containing CS_2 is first removed in the vapour state by rectification in a plate column, and after condensation water is decanted, part of the condensate is returned as reflux and the remainder passed to a second rectifying column, where lighter products and commercial CS_2 is taken off. The bottoms from the two columns are passed to a third column and separated into benzole and toluole, whilst a fraction towards the top of the column rich in thiophene is removed. Benzole practically free from sulphur compounds is obtained. C. L. G.

Analysis and Testing.

532.13 : 621.892

557. The Viscosity of Lubricating Oils. C. Walther. *Oel und Kohle*, 1936, **12**, 221–229.—The following empirical formula expresses satisfactorily the viscosity/temperature relationship of lubricating oils: $W = m(\log T_1 - \log T) + W_{T_1}$ in which $W = \log\log(\nu + 0{\cdot}8)$, ν = viscosity in centistokes. A similar expression may be derived theoretically. When $\log T$ is plotted against W, a straight line is obtained; for a number of oils of one origin the straight lines converge to a common point P (viscosity "pole") as T decreases. Values of P for oils of different origins also lie on a straight line. The value of W at point P (W_P), unlike viscosity index, is

independent of other oils as standards of comparison. With the aid of W_p and of the equation, two measurements serve to determine the whole viscosity curve of an oil. Unless a mixture of oils is concerned, W_p may indicate the origin of the sample. W_p depends on the chemical composition, and, by the action of selective solvents fractions of different W_p, may be separated. W_p is related linearly to density, mean boiling point (50% recovery at 10 mm. pressure), and viscosity index, and is stated to afford considerable insight into the structure of an oil. P. G. H.

665.521.8 : 543.8

558. A New Method of Estimating Tar in Tar-Bitumen Mixtures. P. Kaunart and E. Florian. *Oel und Kohle*, 1936, **12**, 230–235.—In Marcusson's method the mixture is sulphonated and then filtered, the colour depth of the filtrate being taken as a measure of tar content. A series of tests by the authors, using a Leitz colorimeter, gave unreliable results, for which the colloidal nature of the filtrate was held responsible. It was found, however, that the *colour intensity* of the filtrate could be correlated with tar content.

The sulphonated mixture was ultra-filtered and examined in an accurate "step" photometer. Full details are given for carrying out the test and for interpretation of observations. P. G. H.

532.13 : 608.3

559. Patents on Analysis. Sterling Engine Co. and A. H. Stevens. E.P. 442,974, 19.2.36. Apparatus for measuring and indication of the viscosity of liquids. W. S. E. C.

Refining and Refinery Plant.

66.067.75 : 661.183.3

560. The Decolorizing Power of Some Decolorizing Media, in Particular of Bleaching Earths. E. Erdheim. *Petr. Zeit.*, 11.3.36, **32** (11), 5–8.—Experiments are described on the use of bleaching earths for dark-coloured oils. Solutions of a mineral lubricant obtained from Schodnica crude were decolorized in three benzene solutions (benzene I, II, and III), the colours varying in the proportions 100 : 185 : 500 respectively, benzene I representing the palest solution. In practice 40 ml. of the solution together with 0·5 grm. of the decolorizing earth, were shaken for 10 min. in a wide-mouthed bottle fitted with a ground-glass stopper, left to stand for ½ hr., and then shaken again for 10 minutes. After 18 hours' standing the decolorizing value was determined by means of the Hellige Colorimeter, the unbleached solution being used as a comparison standard. The decolorizing values were expressed in per cent. of standard solution.

Several decolorizing earths were investigated comprising: Floridin and Filtrol Supra (American), Frankonit and Montana S (German), activated Bentpolit IB and IIB which were produced in the laboratory, Polonit and SAG (Polish), Sondafin (Rumanian), some natural and activated bleachers, and the results were compared with activated charcoal. The results are tabulated for the 21 bleaching earths.

It was shown that the darker the solution to be decolorized the less the decolorization, and another factor was encountered—namely, "decrease in decolorizing power." This decrease is very small for activated carbon, although this earth is expensive in use. Sondafin gives no decrease in decolorizing power.

The decolorizing values were plotted against the proportional numbers for the bleaching earths. The proportional numbers were obtained in the following way: the same quantity of decolorizing earth was added to all three benzene solutions, benzene I was fixed at 100 for the given decolorizing earth and the per cent. decolorizing values of benzene II and III compared with benzene I were calculated. Three points on the graph were obtained for the decolorizing media and a series of straight lines drawn passing through zero. The author considers that the medium making the least angle with the horizontal axis representing that exhibiting the least "decrease in decolorizing power" is the best, and that a bleaching earth can be evaluated by means of these diagrammatic relationships. Sondafin gave a point only.

Six bleaching earths—namely, Filtrol Supra, Montana S, Bentpolit IB and IIB, SAG and Sondafin were applied in quantities of 2% to bleach wax of m. p. 50–52° C. The waxes were bleached after stirring for ½ hr. at 100° C. The effect could not be determined colorimetrically. It was found that 5% of Bentpolit IIB was necessary to produce wax of a good colour.

Finally it was observed that a solution of Bismarck brown in water (= Benzin III in colour) was decolorized, and that the decolorizing power of bleaching earths in aqueous solution is greater than that in benzene solution. W. S. E. C.

665.521.3

561. Gas Solvent Process in Poland. M. Godlewicz. *Oil & Gas J.*, 20.2.36, **34** (40), 28.—Following on the discovery by Prof. Pilat that methane in propane solution not only has the power to precipitate asphaltenes which cannot be removed by propane alone, but also permits fractionation of lubricating oils by varying the pressure, a special laboratory plant was constructed at the Polmin refinery. Pressure bottles are utilized, and in one of these residue is diluted with propane and asphalt extracted and removed. Colour substances are removed in the same bottle by introduction of natural gas under a pressure of 40 atmos. The clean solution is then pumped to another bottle, where lubricating oils are fractionated by introduction of the natural gas at a pressure of 150 atmos. Other petroleum fractions, and indeed crude oil itself, may be fractionated in a similar manner by suitable pressure regulation. When light fractions are present, higher pressures must be used for lubricating-oil extraction. The precipitating power of hydrogen and nitrogen is not so great as that of methane. Judging from work carried out on Urycz residue, this fractionation method yields lubricating oils of viscosity index 70 when pipe-still distillation of the same residue yields oils of viscosity index 14–19. Other typical Polish asphalt base, wax-free crude oils exhibited similar behaviour, and yielded oils very resistant to oxidation on fractionation, whereas by distillation high-grade oils could not be produced from these crude oils even with the aid of selective solvents. Foreign oils of naphthene-base which were tested behaved similarly. A photograph of the apparatus is provided. R. A. E.

66.074.37: 665.521.3

562. Removal of H_2S from Kerosine by Vacuum Flashing. G. M. Woods. *Petr. Eng.*, Feb. 1936, **7** (5), 84.—The possibility of removing H_2S from kerosine by vacuum flashing has been investigated on a laboratory scale. The raw distillate was run continuously into a 3-litre flask kept under a vacuum of 20–40 mm. of mercury, and the bottoms and tops were continuously withdrawn. From 62 to 94% of the H_2S was removed by this means, the best results being obtained under the lower vacuum and at a slower charging rate. The kerosine loss due to flashing was 0·02–0·05%. From the data obtained it appears that the H_2S content of a kerosine could be lowered to 0·05 lb. per brl., the remainder requiring a caustic wash. With kerosines of high H_2S content (more than 0·4 lb./brl.) the saving in caustic soda would more than offset the cost of the flashing equipment. At the laboratory charge of 200 c.c./minute into a 3-litre flask, a 10·5-brl. steel drum would be large enough to handle 1000-brl./day of kerosine. The unit could probably be constructed cheaply at refineries from equipment already on hand. C. L. G.

665.542.4

563. Regeneration of Spent Plumbite. L. K. Adamyan. *Neft.*, 1934, **5** (4), 24.—The wet precipitate obtained on settling the spent doctor solution is placed in sheet-iron pans and exposed to the action of air for 10–12 hours, whereby lead oxide and sulphur are produced. A 90–95% recovery is claimed. For. Petr. Techn.

665.542

564. Zinc Chloride Treatment of Cracked Gasoline. L. Aleksandrov. *Neft.*, 1934, **5** (13), 9–10.—In discussing the $ZnCl_2$-treating method the following recommendations are made :—

(1) Selection of a protective layer for the equipment against corrosion instead of lining with copper ;
(2) Selection of a proper carrier resistant to the reagent ;
(3) Selection of a method to precipitate the reagent on the carrier ;
(4) The development of reconditioning methods for spent $ZnCl_2$.

For. Petr. Techn.

665.521.4

565. Treating Residues Enriched with Gas Oil. B. M. Erlikh. *Neft.*, 1934, **5** (9), 6–7.—The capacity of Alco units was raised from 650 tons to 1150 tons paraffin distillate per day by utilizing the gas oil obtained in the Badger unit. This gas oil was introduced into the stripped crude oil fed to the vacuum section of the Alco units. This is explained by the higher vapour tension of the mixture due to the presence of gas oil. The residual asphalt was also of a higher grade and a more uniform quality.
For. Petr. Techn.

661.183

566. Activated Clays. M. L. Blagodorov. *Neft.*, 1933, **4** (12), 14–15.—A highly activated clay was prepared by treating the natural Russian clay askinit with sulphuric acid of 20% strength, whereby $Al_2(SO_4)_3$ was obtained as a by-product. The requirements for this clay in treating bright stocks are about one-quarter of the ordinary clay. For. Petr. Techn.

665.521.5

567. Baku Lubricating-Oil Treating Plant. K. N. Bagirov. *Neft.*, 1934, **5** (1), 19–20.—The lubricating oil, primarily freed of naphthenic acids by washing with dilute caustic soda, is treated with 2·5–3·5% of 92–94% acid, percolated with a gumbrin clay (200 mesh) containing 10–12% water, which is passed first through the convection and then through the radiant tubes of a pipe still, where it is heated to 275° C., being further passed through an evaporator for the removal of SO_2 and light fractions formed as the result of overheating. The heavy oil and the clay are passed through spray condensers at 110–115° C., through Sweetland and blotter presses to separate the clay and finally to storage. The light ends are used as fuel. For. Petr. Techn.

66.048.37

568. Factors Affecting the Design of Bubble-Cap Columns. L. C. Strang. *J.I.P.T.*, 1936, **22**, 166–176.—The design of bubble-cap columns is discussed under foaming, free-space column velocity, vapour up-take area and pressure drop across the plate, height of the caps, design of the slots, height of the slots and distribution of vapour and liquid. G. R. N.

621.643.412

569. First Report of the Pipe Flanges Research Committee. Instn. of Mechanical Engineers, presented by H. J. Gough, 21.2.36. *The Engineer*, 1936, **161**, 226, 256 and 296.—The first experimental tests carried out consisted of determinations of the effectiveness of various types of joints and gaskets between flanges at room temperature. These were made in a special apparatus providing uniform axial loading on the surfaces of two dummy flanges machined to represent 14-in. flanges on a pipe 8 in. I.D. The internal pressure necessary to cause leakage was determined for various axial loads. Tests were made on metal-to-metal contact; surfaces smeared with grease, graphite, boiled oil, etc.; various packing materials containing asbestos; metallic packing rings of various forms.

Metal-to-metal contact gave poor results, but improvement was effected by machining the surface to give two upstanding rings $\frac{1}{4}$ in. wide. Even these results were not so good as those obtained with solid steel or copper rings.

Oil and colloidal graphite, and grease and colloidal graphite when applied to the surfaces improved them, but the results were still too low to be satisfactory. Other jointing compounds also gave improvement, but in general the results were irregular.

All packings containing asbestos gave good results, but there was a tendency for them to blow out when the ratio $\frac{\text{axial load}}{\text{hydraulic load}}$ was less than 1·3.

Corrugated sheet-metal packing was entirely unsatisfactory. All the solid metal rings, whether round or square section, were excellent. A steel ring having a serrated surface was poor when there were twenty-five serrations, but was improved when the number of serrations was reduced. When two or four serrations were used the results obtained were the best of any of the tests.

Experiments were next made to test the flexibility of stud bolts and full-size 8-in. flanges at air temperatures. These were followed by tests on bolts at high temperatures (975° F.) under creep conditions. It was found that the use of a mild steel nut with an alloy steel bolt gave inferior results to those obtained when an alloy steel nut was used. Under-cut bolts and over-size bolts were inferior to the standard bolts. In order to reduce the creep of a bolt the length of the threaded portion subjected to load should be a minimum.

The proportion of the total creep contributed by the washer is small, and mild-steel washers, if of good quality, are satisfactory.

Finally two tests were made on full-scale flange assemblies at high temperature and pressure. The initial stress applied on tightening up was estimated from previous results on bolt extension. The flanges were 14-in. flanges on 8-in. I.D. pipe, and a reinforced asbestos gasket was used. Temperature and steam pressure were 950° F. and 1400 lb./sq. in. The creep of gasket, flanges and nuts, and the relaxation and creep of the bolts were measured as the test proceeded. The joint had a life of 23 days before failure under the above conditions. Means of prolonging the life are discussed, and further tests projected are described. P. D.

665.52: 620.197.3

570. Corrosion of Distillation Units. S. M. Silakov. *Neft.*, 1934, **5** (17), 15–17.—The corrosive action of a crude containing sulphur, sulphur compounds, Mg, Ca and other salts was greatly lowered, and the distillates obtained were of a higher grade by introducing "antikorrozin" in the cycle. "Antikorrozin" was prepared as follows: Alkali sludge was dissolved in 2 vol. water at 90–95° C. and a $ZnCl_2$ solution was gradually introduced whereby zinc naphthenate was obtained. The solution was then discharged, and the viscous zinc naphthenate was dissolved in gas oil heated to 95–100° C., and introduced into the crude oil before its entrance into the tube still, the treatment requiring about 0·06% of $ZnCl_2$ calculated on the crude oil.

For. Petr. Techn.

665.54: 669.144

571. Alloy Steels for Refinery Equipment. H. D. Newell. *Oil & Gas J.*, 20.2.36, **34** (40), 32.—Alloy steels at present widely used are (1) 5% Cr and 0·50% Mo for milder conditions of temperature, pressure and corrosion, (2) 18–8 for the most severe conditions. In an endeavour to ascertain the most suitable intermediate alloy steel in respect of oxidation resistance, corrosion resistance and creep strength, much experimental work has been carried out on alloys containing additions of Mo, V and W. The alloy finally selected as the most generally suitable is composed of C 0·15% max., Mn 0·50% max., Si 0·50%, Cr 8·0–10·0%, Mo 1·25–1·75%. The nominal composition of the alloy, which is known as Croloy 9, is 9·25% Cr, 1·50% Mo, 0·12% C. The physical properties of the alloy and the minimum physical requirements of tubes constructed from it are given. These suggest suitability for semi-severe elevated temperature service up to about 1250° F. metal temperature in such applications as furnace tubes, heat-exchanger tubes and superheater tubes in steam boilers. Tubes are in service in many oil refineries for test purposes in order to confirm the suitability of the alloy as indicated by the laboratory tests.

R. A. E.

669.71 : 665.54

572. Use of Aluminium in Refinery Plant. Anon. *Oil & Gas J.*, 20.2.36, **34** (40), 42.—Aluminium is very resistant to corrosion by H_2S, but is not suitable for handling brine. It is therefore not as a rule used for drilling equipment, but may be used with advantage for the sides and roofs of flow, lease and storage tanks. By this means the life of the steel tank-bottom is also increased as electrolytic action is avoided. With steel roofs, iron sulphide is formed, falls to bottom and sets up galvanic action with the steel bottom, brine acting as electrolyte. Aluminium may also be used for the ladders, manhole rings, cast fittings and thief hole-covers, and has been used as a sheathing for wooden tank roofs. Its use to the fullest extent will increase the initial cost of the tank, but may often so increase the life as to prove an economy. In the refinery which handles sour crudes, aluminium has been used to advantage in heat exchangers,

gas lines handling corrosive gases, absorbers, condensers, bubble-towers and bubble-caps. Tank breathers, flame arresters and floats and chains for tank gauges are often constructed of aluminium.

Owing to its light weight it may also be used advantageously in the construction of portable buildings, tank-trucks, tank-cars, measuring-rods and loading-funnels. High electrical conductivity per unit weight makes it useful, when reinforced with steel, for telephone lines. Aluminium foil and paint are used for coating tanks to reduce temperature fluctuations of the contents, and so reduce breathing and loss by evaporation. The term aluminium in this article includes alloys as well as pure aluminium. The mechanical properties of a number of the alloys which have the maximum resistance to corrosion are tabulated. The particular merits and applications of the individual alloys quoted in the table are discussed. R. A. E.

66.041.546 : 608.3

573. Patents on Refinery Plant. W. F. Carey and I.C.I. Ltd. E.P. 442,779, 14.2.36. Improvement in furnace for the production of hot gases by the combustion of solid fuels. A large mixing-chamber is provided with baffles, so that the gases are first divided into two streams and then rejoined before leaving the mixing-chamber. A means is provided to allow efficient poking of the lower part of the bed.

66.048.37 : 608.3

A. Borsig-Maschinenbau A.G. E.P. 443,092, 20.2.36. Improved fractionating column for the passage of small quantities of fluid.

66.048 : 608.3

C. L. Newport and H. C. Smith. U.S.P. 2,033,644, 10.3.36. A retort lining is described for stills, fractionators, etc., which comprises a mixture of mineral wool, distomaceous earth and portland cement.

M. P. Youker. U.S.P. 2,034,789, 24.3.36. An apparatus and process are described for the fractional distillation of hydrocarbon liquids.

H. D. Loeb. U.S.P. 2,035,900, 31.3.36. A furnace is described for heating fluids in cracking operations. W. S. E. C.

Cracking.

665.53

574. Automatic Control Provided for Outlet Temperature of Cracking Unit. Anon. *Nat. Petr. News*, 26.2.36, **28** (9), 26.—An instrument is described for the automatic control of the oil outlet temperature in cracking units. It is a modified potentiometer controller actuated by a thermocouple in the oil line. The instrument is set according to a predetermined temperature. Deviations from the temperature then cause a galvanometer needle to be deflected by an amount proportional to the deviation. Control valves are then adjusted through relay systems until the temperature is again normal. H. G.

665.53

575. Cracking and Reforming Oklahoma City Crude. J. C. Albright. *Refiner*, 1936, **15** (2), 51–54.—Gives relevant data on the operation of a cracking and reforming unit handling products from crude oil obtained in the Garber field. The crude is skimmed or reduced according to requirement in shell stills and topped crude, gas oil and naphthas are charged to the combined cracking unit. The stabilized gasoline is washed with caustic and doctor and inhibited, the total treating cost being $0·017 per brl. Three grades of gasoline are produced, and their total yield is around 66·4% on the crude. G. R. N.

665.53 : 608.3

576. Patents on Cracking. Coutts & Co., F. Johnson & I.G. E.P. 442,592, 7.2.36. Process for thermal splitting of hydrocarbons at 400–500° C. and under a pressure over 40 atm., in the presence of a catalyst. The latter is a solid unactivated metal from groups 2–4 of the periodic system or from the iron group, *e.g.* Zn, Mg or Fe in an amount

equal to 0·1–5% of the weight of the substance treated with the addition of chlorine acting as an acid under the conditions of working. W. S. E. C.

Hydrogenation.

66.094.1 : 668.3

577. Patents on Hydrogenation. International Hydrogenation Patents Co., Ltd. E.P. 443,306, 26.2.36. Production of low-boiling hydrocarbons, *e.g.* motor spirit, kerosene, etc., by catalytic destructive hydrogenation of liquid carbonaceous materials. The materials are distilled under atmospheric pressure to 350° C., and subsequently distilled under reduced pressure (10–15 mm. of mercury) and at 350–400° C. A quantity of hydrogen amounting to 1000–6000 cub. metres/ton of initial material is used. A pre-refining with sulphuric acid, aluminium chloride or an adsorptive agent may be carried out before hydrogenation.

International Hydrogenation Patents Co., Ltd. E.P. 443,338, 26.2.36. Hydrogenation process as described above, the initial material being pre-treated with liquid propane, a propane–ethane mixture or butane.

International Hydrogenation Patents Co., Ltd. E.P. 443,339, 26.2.36. Process as described above, the initial material being pre-treated with phenol, aniline, ketones, nitrobenzene, sulphur dioxide, etc.

W. B. Plummer. U.S.P. 2,033,737, 10.3.36. A catalyst is described for use in hydrogenation and cracking of crude petroleum and carbonaceous substances for the production of motor spirit and lubricating oil. It comprises a slag produced in the refining of ferro-alloys and contains 1–10% of an oxide of a metal from the class chromium, molybdenum, tungsten, vanadium, titanium and manganese, 5–20% of iron oxide, 10–70% of silica and 5–50% of alkaline-earth oxides.

C. T. Loughrey. U.S.P. 2,034,818, 24.3.36. Petroleum oil is subjected to the action of nascent hydrogen and hot fixed gases to cause hydrogenation and simultaneous desulphurization and dehydration of the oil. Volatilized sodium is mixed with the fixed gases and directed on the aqueous oil; nascent hydrogen is applied directly to the oil to increase hydrogenation effects.

C. Krauch and M. Pier. U.S.P. 2,035,133, 24.3.36. Conversion of carbonaceous materials, *e.g.* tars, mineral oils, etc., by destructive hydrogenation first in the liquid phase in a reaction zone, and then passing the products, after removal of vaporous reaction products, into a second reaction zone containing hydrogen gas to effect further hydrogenation. The catalyst is a porous mixture of molybdic acid and zinc oxide.

H. E. Potts. E.P. 442,573, 11.2.36. Preparation of molybdenum or tungsten sulphide catalysts for the treatment of hydrogenating gases. The initial substance containing tungsten and/or molybdenum is treated in a dry process with volatile oxygen-free sulphur compounds (H_2S) with an addition of ammonia preferably under pressure. The intermediate thio-salt formed is isolated and decomposed at 425° C. in a current of hydrogen. The catalyst may also be prepared in liquid hydrogen sulphide in the presence of ammonia. The process is also applicable to the regeneration of used catalyst containing tungsten or molybdenum sulphides, these being treated after preliminary roasting with hydrogen sulphide in the presence of ammonia or ammonium salts.

International Hydrogenation Patents Co. Ltd. and I.G. Co. E.P. 443,133, 21.2.36. Acid constituents in the reaction products issuing from the reaction vessel as gases or vapours in destructive hydrogenation processes are removed or neutralized by bringing them into direct contact with the initial materials in liquid form.

W. S. E. C.

Polymerization.

66.095.26

578. Temperature Determines *Iso*butane Yield in the Polymerization of Ethylene. Anon. *Nat. Petr. News*, 26.2.36, **28** (9), 30.—A study of the polymerization of ethylene, under high pressure and in the presence of 90% phosphoric acid, as catalyst has been carried out by V. W. Ipatieff and H. Pines. Within the temperature range 250–330° C. a mixture of paraffinic, olefinic, naphthenic and aromatic hydrocarbons was obtained. It was found that the concentration of paraffin was greatest in the lower-boiling fractions, whilst the aromatics were confined to fractions boiling above 225° C. The

following figures indicate that the proportion of *iso*butane in the products of the reaction increases with increase of operating temperature.

Boiling Range.	Operating Temperature.			
	250° C.	280° C.	300° C.	350° C.
Below 110° C. (% wt. recovery)	37	31	42	46
110° C.–225° C. . . .	26	33	20	14
225° C.–300° C. . . .	27	23	26	29
Above 300° C. . . .	10	13	12	11

H. G.

66.095.26 : 608.3

579. Patents on Polymerization. R. E. Burk. U.S.P. 2,033,878, 10.3.36. Residual gas from cracking plants is subjected to molecular decomposition in a zone at 1600–2100° F., the temperature is then reduced to about 1100° F., but maintaining the temperature above readjustment level. The products are then transferred to another zone and polymerized at 1350–1750° F.

T. T. Gray and T. S. Kenyon. U.S.P. 2,034,575, 17.3.36. Production of motor fuel by polymerization of gases containing unsaturated hydrocarbons.

R. F. Ruthruff, J. K. Roberts and M. T. Carpenter. U.S.P. 2,035,409, 24.3.36. Production of liquid products from dilute olefinic gases by concentrating the gases to increase the olefin content and polymerizing them at elevated temperatures and pressures to give normally liquid products. The unconverted gases are cracked at 1300–1750° F., quenched with dilute olefinic gases and the quenched mixture polymerized. W. S. E. C.

Motor Fuels.

665.543

580. Study of Gasoline Treating Reagents shows need of Improved Methods. C. Wirth and G. B. Murphy. *Oil & Gas J.*, 6.2.36, **34** (38), 28.—To-day practically all marketed gasolines are treated by a sweetening process to eliminate the odour of mercaptans. This is usually accomplished by conversion of the mercaptans to less nnocuous compounds, rather than by their removal, owing to the relative ease of treatment. Unfortunately, such methods have a number of limitations, and the quality of the treated gasoline suffers in other respects.

Many methods are based on the oxidation of mercaptans to disulphides. The latter contribute materially to poor colour stability, poor susceptibility to effect of T.E.L. and gum inhibitors and to actual loss in octane number. These effects are illustrated. In addition, the presence of free sulphur, normally required in excess to assure complete conversion to disulphides, causes a poorer colour stability and corrosion. The effects of oxygen on cracked gasoline, resulting in peroxidation, are detrimental to inhibitor susceptibility and anti-knock properties. With these facts in mind the common methods of treatment are reviewed.

Plumbite and free sulphur treatment suffers from all these disadvantages. Sodium hydroxide treatment would possess an advantage over the plumbite treatment in eliminating formation of disulphides, but it removes all natural inhibitors. It suffers from the disadvantages of incomplete elimination of mercaptans of higher mol. wt. and also free sulphur if present. Hypochlorite treatment removes mercaptans as water-soluble sulphones and sulphoxides and is very satisfactory for straight-run gasolines with no free sulphur. Cracked gasolines, however, are readily discoloured and oxidized by the treatment resulting in troubles previously described. The use of brucite, calcium hydroxide or slaked lime gives rise to the same disadvantages as plumbite treatment, except that less natural inhibitors are removed. The Cannon process suffers from similar defects. Treatment with lead sulphide in caustic solution gives rise to the same objections as plumbite treatment.

It is obvious, therefore, that all sweetening reagents now in commercial use have

deleterious effects on the properties of the treated gasoline. A reagent not suffering from any of the disadvantages mentioned has yet to be found. R. A. E.

661.91 : 662.764

581. Compressed Gas as Motor Fuel. R. Cook. *Petroleum Times*, 29.2.36, **35**, 273.—The relative costs of compressed coal gas, petrol and heavy oil are reviewed.

Comparing, first, compressed gas and petrol, the following observations relative to the former are made :—

1. A higher thermal efficiency is obtained than with petrol.
2. The CO content of the exhaust gases is very much lower than with petrol.
3. Starting is at least as good.
4. Flexibility and acceleration are superior than with petrol when engine is cold.
5. A power output equal to that of petrol can be obtained.

The principal drawback to the use of gas is the extra weight involved by storage cylinders, often sufficient to increase the licence duties, and the limited recharging facilities. With gas at 2*s*. 6*d*./10³ ft.³ (petrol equivalent 7·95*d*./gal.) gas can compete with petrol as fuel for vehicles of less than 2 tons unladen weight covering 10,000–12,000 miles per annum in journeys of not more than 75 miles each. With heavier vehicles, the heavy-oil-engined vehicle scores. Under present conditions the relative costs of gas and heavy fuel oil used on a 5-ton lorry covering 12,000 miles per annum are 12·35*d*. and 8·63*d*. per gallon respectively. H. G.

547.53

582. Determination of the Aromatic Content of Commercial Benzenes. Reprint from *Austrian Petr. Inst. Publicn.* No. 3, edited by F. Lang. *Petr. Zeit.*, 19.2.36, and 26.2.36, **32** (8), 1 and (9), 1.—This is a report of the work carried out by H. Suida in the Institute of the Chemical Technology of Organic Substances in Vienna. The work is prefaced by an interesting historical and critical study of previous work on this subject, and relevant literature is cited. The following methods are described : separation of hydrocarbon groups in benzene by means of selective solvents, determination of aromatic hydrocarbons based on determination of physical constants (critical solution temperature and aniline point, specific gravity, refractive index, etc.), colorimetric methods of determination and the determination of unsaturated and aromatic hydrocarbons by chemical means.

Experimental work on the determination of aromatics is detailed in which synthetic mixtures composed of aromatic-free benzene and known quantities of benzole, toluol and xylol were fractionated in a special type of flask to obtain three fractions—namely, benzole fraction to 95° C., tolul fraction to 122° C. and xylol left in the residue. The individual fractions were analysed for aromatics utilising Sachanen's method (determination of critical solution temperature of benzene in aniline before and after the removal of aromatics), Riesenfeld and Bandte's sulphonation method and Hess' nitration method. The apparatus used is illustrated and results are tabulated for aromatics present in the fractions and in the unfractionated mixtures. Similar data are also given for various groups of commercial benzenes. W. S. E. C.

665.521.3

583. Examination of Some Rumanian Benzines. V. Cerchez. *Oel und Kohle*, 1936, **12**, 271–273.—Five samples were examined according to procedure described in a previous publication (see Abs. No. 1060, 1935), special reference to octane number being made. The benzines were differentiated by curves showing Q value and volume respectively plotted against the b. p. of 2° fractions. Benzines with the higher octane numbers were the richer in fractions boiling below 100° C., the octane number increasing with the Q value of these fractions. No relationship was found between octane number and total aromatics. It is concluded that the conventional description of composition (aromatics, unsaturateds, etc.) gives no indication of detonating properties, and that naphthenes and side-chain paraffins may themselves contribute to a high octane number. P. G. H.

662.742 : 665.58 : 608.3

584. Freeman Process of Manufacturing Motor Spirit and Oil from Coal. Anon. *Engineering*, 1936, **141**, 229–230.—The experimental plant consists of a vertical cylindrical vessel divided into eight separate chambers heated by gas burners and thermostatically controlled, the temperature increasing in steps from the top chamber to a maximum of 850° F. at the bottom. The coal passes through the series of chambers from the top to the bottom. Moisture is expelled in the uppermost chamber, and the hydrocarbons are expelled in subsequent chambers and passed through reflux condensers. Some of the gas and the condensate produced is returned to the chamber preceding that in which it was formed, increased yields, it is claimed, being obtained in this way. The gas obtained, supplemented by producer gas made from some of the coke residue, is used in the heating burners.

From soft bituminous coal the anticipated yield is 31 gallons of spirit and oil per ton, of which 7½ gallons will be motor spirit, the balance being light and heavy diesel oil and fuel oil. No tar is produced, no catalyst is required and the residue is a hard coke in pellet form. When shales or Cannel coals of high volatile content are used, a yield of liquid hydrocarbons exceeding 100 gallons per ton can be obtained.

Results have justified the erection of a full-scale plant. W. A. W.

665.521.2 : 665.542 : 608.3

585. Patents on Motor Spirit. R. B. Day. U.S.P. 2,029,757, 4.2.36. Removal of sulphur, colour, and gum-forming constituents from gasolines by treatment with ammonium chloride vapours in the presence of zinc at temperatures high enough to decompose the ammonium chloride.

R. B. Day. U.S.P. 2,029,758, 4.2.36. Cracked hydrocarbon distillates are treated with aqueous hydrogen chloride in the presence of copper under conditions to remove gum-forming olefins which are readily reactive with sulphuric acid. The distillates are then desulphurized by sulphuric acid treatment.

J. C. Morrell. U.S.P. 2,029,785, 4.2.36. Cracked spirits containing mono-, di- and tri-olefines are treated in the vapour-phase with a mixture of sulphuric and phosphoric acids in order to remove colour, gum and sulphur.

R. H. Crosby and B. R. Carney. U.S.P. 2,030,245, 11.2.36. Removal of sulphuretted hydrogen from pressure distillates by treating with an aqueous lime suspension in a treating zone in the absence of a gas, and under super-atmospheric pressure. The resulting mixture is maintained entirely in a liquid form.

F. R. Moser. U.S.P. 2,031,932, 25.2.36. Sweetening of petroleum distillates by means of alkaline hydroxide and elementary sulphur, and adding to the resultant product a small quantity of an unsaturated hydroaromatic compound capable of inhibiting the corrosive action of sulphur, *e.g.* tetrahydronaphthalene, pinene, *cyclo*-hexene, etc.

J. M. McGee and R. M. Roe. U.S.P. 2,032,662, 3.3.36. Desulphurization of cracked gasoline by separating into a lower-boiling fraction of less volume than the higher-boiling fraction and treating the low-boiling fraction with 89–98% sulphuric acid and the high-boiling fraction with 93–104½% sulphuric acid. The sludge is removed and the fractions combined to obtain gasoline.

A. Pott, H. Broche, and K. Ehrmann. U.S.P. 2,033,297, 10.3.36. Refining and stabilizing light oil (obtained by high-temperature coking of coal), containing unsaturated hydrocarbons. The light oil is heated to 40° C. to convert the unsaturated constituents into sulphonic acids and esters and the products are treated after washing with alkali in the heat.

J. C. Morrell. U.S.P. 2,034,197, 17.3.36. Refining of low-boiling cracked distillates by treating with a concentrated aqueous solution of alkali metal hydroxide containing alkali metal permanganate.

W. M. Stratford. U.S.P. 2,034,317, 17.3.36. Production of motor spirit from highly-cracked naphtha distillate containing unsaturated hydrocarbons. The distillate is heated to 450–700° F. under a pressure above 1000 lb./sq. in., and then passed through a bed of fuller's earth. The pressure is reduced to effect the distillation of naphtha from higher-boiling polymerized compounds and the treated distillate naphtha is passed through a bed of fuller's earth under a pressure of 350–500 lb./sq. in. The polymerized compounds are separated from the treated and purified naphtha.

F. W. Sullivan, Jr. U.S.P. 2,034,495, 17.3.36. Solvent fractionation of cracked motor spirit by treating 1 vol. of the spirit with 2 vols. of sulphur dioxide and 0·8 vol. of carbon dioxide at −115° F. The two liquid phases formed are separated.

C. E. Dolbear. U.S.P. 2,034,712, 24.3.36. Refining of petroleum distillates by vapour-phase treatment at a temperature below the boiling point of the least volatile component (and below 800° F.). The vapours are passed through a pervious bed of reactive adsorbent material in a fragmentary condition, *e.g.* partly hydrated calcium oxide having its pore surfaces coated with alkali metal hydroxide.

W. A. Schulze and L. V. Chaney. U.S.P. 2,034,837, 24.3.36. Sour gasolines are sweetened by agitating without the aid of lead compounds at atmospheric temperature, with a solution of caustic soda and sodium polysulphide in an aqueous solvent containing 1–15% of a saturated aliphatic alcohol. The gasoline is then separated from the treating solution.

H. O. Forrest *et alia*. U.S.P. 2,035,120, 24.3.36. Production of motor spirit by aquolysis from heavy hydrocarbon oil (*e.g.* gas oil) by blending with water in the average molecular ratio of 80 : 1 and heating to 1000° F. under 3000 lb. press./sq. in. for 10–100 seconds. At least three-quarters of the oil is converted into volatile motor spirit without any substantial carbonization.

A. Lachman. U.S.P. 2,035,607, 2,035,608, 31.3.36. Refining of gasoline or naphtha obtained from cracking operations. The products are caused to vaporize from a heated commingled mixture of the product and a water solution of a zinc, iron or cadmium salt by reducing the pressure on the heated mixture.

A. Lachman. U.S.P. 2,035,609, 31.3.36. Refining of cracked gasoline as described in the above patent, a copper salt being substituted for the zinc, iron or cadmium salt.

A. Lachman. U.S.P. 2,035,610, 31.3.36. Refining of cracked gasoline as described above using an aluminium salt.

A. A. Wells. U.S.P. 2,036,166, 31.3.36. Naphtha from cracking operations is refined by treating counter-currently in a vaporizing zone with a slurry of clay in gas oil.

A. Lachman. Re. 19,879, 3.3.36. Refining of motor spirit, lubricating oil, etc., by passing hot vapours of these materials into a zone to contact them with an aqueous solution of a zinc salt (other than the chloride or iodide) and containing zinc oxide. Water is intermittently introduced into the solution of the salt in order to maintain the salt in solution. The vapours of refined oil are separated from the zinc salt containing zinc oxide and the products of the reaction. W. S. E. C.

Lubricants.

621.899

586. Recovery of Used Motor Oils. Anon. *Neft.*, 1934, **5** (19), 13–14.—In the Vlasenko-Akchurin lubricating oil reconditioning plant the spent oil is placed in an agitator, where it is heated by waste heat to 70–80° C. and is allowed to settle. It is then treated with 3–5% of a 90% solution of $ZnCl_2$ for 15 minutes, left to settle, the sludge discharged through a conical bottom and the oil washed with 10% water. The oil is transferred to a still, and the fuel distilled off using superheated steam. The oil after cooling is filtered. For. Petr. Techn.

621.892.2

587. Manufacture of Greases. W. Maass. *Ole, Fette, Wachse*, 1936 (4), 19–22; (5), 10–14.—The manufacture of greases goes back about 60 years, the first products being simple mixtures of sodium, potassium, or calcium soaps with mineral oils.

Later lime-rosin oil, cold set greases were developed.

In the last 10 years there has been a considerable advance in the technique of grease manufacture. To-day refined mineral oils, fats and fatty acids and high-quality lime are used for the more common greases, whilst K, Na, Mg, Al or Pb soaps may be substituted for special products.

The soap content of the modern greases may vary from 3% to 30%. They may be regarded as emulsions of oil and water stabilized by a soap skeleton, the oil being the continuous phase. Their consistency is influenced by the type and quality of the oil base and soap, as well as the boiling temperature and water content.

Any fat or fatty acid can be utilized, the best products being made from horse fat, tallow or lard. It has been found that fats containing a high percentage of unsaturateds tend to give greases of lower m. p. than those of the stearine type.

The mineral oil content varies from 70 to 97%, and should have a viscosity 3–5° E. at 20° C. Better qualities often have an oil base of 3–5° E. at 50° C. A number of extreme pressure greases on the American market differ from the ordinary type only in the higher viscosity of the oil base. The American greases are often scented with sassafras oil or nitrobenzene. This is not customary in Germany. However, zinc white is often added to German greases to mask the fluorescence of the mineral oil and aniline dyes to obtain a desirable colour.

Then follows a description of a typical grease plant using the open-pan process, and diagrams illustrate the lay-out of such an installation. It is suggested that the plant include roller mills which can be used for milling the grease, besides incorporating graphite, mica, asbestos, etc., if desired.

An account is given of the manufacture in such a plant of a typical cup grease containing 85% refined mineral oil 4–5° E. at 20° C., 12% fish fatty acids, 2% CaO, 1% Zn-white and 0·02% aniline dye.

The fatty acid is saponified with milk of lime in the presence of one-third of the oil, and the resulting soap examined for water content and alkalinity. The soap is rendered neutral by the addition of either oleic acid or caustic soda. The zinc-white is then incorporated and the balance of the mineral oil run in. The dye is not added until the grease has cooled somewhat.

The stirring of the more or less finished grease must be carefully watched. A grease with too little stirring will be hard and have little polish, whilst with too much stirring it is likely to be too soft and have a rather low m. p.

The manufacture of a typical grease using a neutral fat is then described, the fat being a fish oil containing 8–9% free fatty acid.

A description of the manufacture of an American No. 3 cup grease then follows. This is made from 14% lard oil, 3% tallow, about 2·5% $Ca(OH)_2$, 80·5% refined mineral oil 12–14° E. at 20° C., 0·06% nitrobenzene. This results in a grease melting at 90–95° C. and with an A.S.T.M. penetration at 25° C. of about 180.

The article is to be continued, when the pressure autoclave method of manufacturing greases will be described. D. L. S.

665.521.5 : 608.3

588. Patents on Lubricating Oil. Standard Oil Development Co. and C. Arnold. E.P. 442,979, 19.2.36. Lubricating oils are improved by blending with a stabilized hydrogenated polyvinylacetylene or polychlorprene, sulphur or a sulphur compound being added as an inhibitor.

R. N. Watts and J. McA. Harris, Jr., U.S.P. 2,033,057, 3.3.36. Removal of wax haze, *i.e.* large fluffy particles which do not settle on standing, from lubricating oils, in particular those produced synthetically or by hydrogenation. The oil is heated alone to 350° F. and then contacted with separately heated batches of activated clay at progressively decreasing temperatures above 240° F. The coloured impurities and then the wax haze are removed.

S. W. Ferris. U.S.P. 2,033,932, 17.3.36. Fractional extraction of viscous oil of viscosity gravity constant above 0·835 with allyl alcohol to produce an oil of viscosity gravity constant less than 0·828.

S. S. Kurtz, Jr., U.S.P. 2,033,942, 17.3.36. Viscous fractions from crude oil containing paraffinic and naphthenic hydrocarbons are extracted with dibutyl sulphone, and the oil is separated into portions respectively richer in paraffinic and naphthenic hydrocarbons.

J. F. Wait. U.S.P. 2,034,068, 17.3.36. Refining of petroleum hydrocarbons by means of active metal at 200–400° C. Vapours of petroleum formed under vacuum are allowed to flow through a reaction zone through which fused active metal circulates. The petroleum vapours are passed to a second reaction zone also containing fused sodium. The metal is continuously withdrawn to a separating zone, where accumulated organic impurities separate; freshly fused metal is added to the fused mass in the circulation zone in order to increase its high activity.

G. F. Chase and J. A. Anderson. U.S.P. 2,034,175, 17.3.36. Removal of wax from

mineral oil distillates by adding small quantities of a crystallization regulator derived from a mineral oil residue which is soluble in light naphtha and insoluble in propane. The oil is diluted to reduce its viscosity, then chilled to congeal the wax.

C. C. Benz. U.S.P. 2,034,891, 24.3.36. Apparatus for vacuum distillation of lubricating oils.

R. K. Stratford and G. W. Gurd. U.S.P. 2,035,102, 24.3.36. Solvent extraction of lubricating oils containing asphalt using undiluted phenol and introducing hydrogen chloride gas into the mixture in a quantity which is insufficient to cause sludge separation. The mixture is agitated, and the layers are allowed to separate.

H. G. Smith. U.S.P. 2,035,349, 24.3.36. Refining of crude oil to produce lubricating oil by treating with concentrated sulphuric acid (98% by wt.).

F. M. Archibald. U.S.P. 2,035,418, 24.3.36. Stabilization of U.S.P. white oils against oxidation effects by adding to a filtered white mineral oil 1–2% (of the quantity of filtered white oil) of an oil obtained by extracting clay that has been used previously in the filtration step of the manufacture of U.S.P. white mineral oil.

B. Y. McCarty and W. E. Skelton. U.S.P. 2,035,490, 31.3.36. Removal of wax from hydrocarbon oil using *ortho*-dichlorobenzene and a liquid from the group consisting of ethylene glycol monoethyl ether and diethylene glycol monobutyl ether at − 10° F., when the mixture has almost complete solvent action on the oil, but no solvent action on the wax.

B. Y. McCarty and W. E. Skelton. U.S.P. 2,035,491, 31.3.36. Process as described in the above patent specification, the mixture consisting of *ortho*-dichlorobenzene and commercial amyl alcohol.

L. D. Jones. U.S.P. 2,035,655, 31.3.36. Continuous chemical treatment of lubricating oil with concentrated sulphuric acid in small quantities followed by continuous centrifugal separation of the sour oil from the sludge.

D. R. Merrill. U.S.P. 2,031,117, 18.2.36. Dewaxing of oil using liquid propane.

U. B. Bray. U.S.P. 2,031,204, 18.2.36. Production of lubricating oil from oil containing asphalt and wax by means of liquid propane under pressure to remove asphalt and chemically treating the oil and wax (freed from propane).

U. B. Bray. U.S.P. 2,031,205, 18.2.36. Solvent extraction of lubricating oils using dichlorethyl ether, phenol, liquid sulphur dioxide, etc.

C. E. Swift. U.S.P. 2,031,234, 18.2.36. Fractionation of oil containing asphalt by mixing the oil with liquid propane, separating the precipitated asphalt and extracting the substantially asphalt-free oil with alcohol.

T. R. Donlan. U.S.P. 2,031,939, 25.2.36. White oils or kerosenes are treated with sulphuric anhydride and fuming sulphuric acid at a temperature above 80° C. and below the b. p. of the hydrocarbon oil in order to improve their odour and colour.

D. R. Merrill. U.S.P. 2,029,382, 4.2.36. Production of lubricating oils by commingling cracked residuum pitch with a solvent capable of dissolving high-molecular-weight hydrocarbons from the pitch and leaving an insoluble residue. The solvent solution of high-molecular-weight hydrocarbons is separated from the residue and commingled with an aromatic solvent and acid-treated.

W. H. Beardsley. U.S.P. 2,029,605, 4.2.36. Refining of S. Texas lubricating oil with sulphuric acid.

R. E. Wilson. U.S.P. 2,029,687–8, 2,029,690 and J. Robinson. U.S.P. 2,029,691, 14.2.36. Process for continuous counter-current contacting of two liquids, *e.g.* lubricating oil with a selective solvent.

G. L. Parkhurst. U.S.P. 2,029,689, 4.2.36. Solvent fractionation of lubricating oils and naphthas using liquid sulphur dioxide.

S. H. Diggs. U.S.P. 2,030,284, 11.2.36. Solvent recovery in lubricating oil extraction processes, in particular of dichlorethyl ether.

621.899

G. J. Strezynski. U.S.P. 2,030,480, 11.2.36. Process for reclaiming oil containing carbon by mixing with an aqueous solution of caustic soda to which is added a very small quantity of triethanolamine. The mixture is heated, and the carbon separated by centrifuging.

621.899 : 608.3

Stream-Line Filter Co. and T. E. Beacham. E.P. 442,081, 29.1.36. Method of separation of contaminating impurities from used lubricating oil by filtering

the oil and then treating the filtered oil in a still from which the vapour is withdrawn by means of a vacuum pump through a condenser. The condensed fuel is led to a receiver and the liquid from the still is conveyed to a clean oil reservoir. The receiver and reservoir are closed receptacles and are connected at the upper portion to the vacuum pump.

66.094.17 : 608.3

C. View. E.P. 442,023, 30.1.36. Hydrogenation of hydrocarbons, *e.g.* coal tars, petroleum pitches, etc., using caustic soda and/or caustic potash as catalyst. The hydrocarbon mixture is treated in the absence of water prior to hydrogenation so that a homogeneous substance is formed containing the catalyst in the form of a hydrocarbon derivative; this substance is then hydrogenated without any new addition of catalyst by a process of homogeneous catalysis.

621.892 : 608.3

Standard Oil Development Co. E.P. 442,921, 18.2.36. Production of lubricating oil of high oiliness from a hydrocarbon lubricating oil base containing a synthetic ester prepared from an aliphatic acid containing less than 10 carbon atoms and an alcohol containing at least 10 carbon atoms obtained by oxidation of a hydrocarbon wax, or by reduction of a fatty acid or sulphation of cracked hydrocarbon wax and hydrolysis of the product.

665.521.5 : 608.3

Aktiebolaget Separator-Nobel. E.P. 442,039, 31.1.36. Solvent extraction of lubricating oils using as solvents phenol, nitrobenzene, dichlorethyl ether or benzene.

Standard Oil Development Co. E.P. 442,161, 3.2.36. Production of lubricating oils for use at high temperatures (150–200° C. or higher), by adding 0·1% of an oil-soluble inhibitor, *e.g.* a polycyclic aryl compound containing an inhibitor group (amino or hydroxyl), and a stabilizer group (oxygen or sulphur atom), attached to the same ring, *e.g.* 1-methyl-3-hydroxy-4-ethylthiobenzene, 2-hydroxy-4-propylthionaphthalene, etc.

Standard Oil Development Co. E.P. 442,289, 30.1.36. Improved lubricating oils are produced by blending the product obtained by esterifying with a carboxylic acid anhydride or halide, a hydroxy fatty acid containing at least 10 carbon atoms in the molecule or its ester in which the carboxyl group is esterified. The esterification product is then hydrogenated.

Union Oil Co. of California. E.P. 442,429, 3.2.36. Separation of wax from lubricating oil or other matter precipitated on cooling the oil. The oil is dissolved in a diluent, *e.g.* benzole, acetone, etc., and the matter precipitated in the solution; the latter is then subjected to an electric field of potential gradient 5000–35,000 volts/in. continuous or interrupted direct current. Wax, asphalt, etc., are deposited.

L. T. Evans. U.S.P. 2,030,577, 11.2.36. Reclaiming journal box waste oil by agitating the heated oil with water and sodium silicate, adding a saponifiable fat, and increasing the temperature while agitating the mixture. The mixture is then allowed to stratify.

L. M. Henderson. U.S.P. 2,030,870, 18.2.36. Solvent extraction of lubricating oils using an alkyl ester of furoic acid.

U. B. Bray. U.S.P. 2,031,095, 18.2.36. Separation of wax from oil which does not contain sufficient asphalt to promote crystallization of the wax. The oil is mixed with asphalt, propane added to precipitate the asphalt, and the solution of oil and wax and insoluble asphalt is chilled to precipitate the wax. The wax and asphalt are separated from the oil and solvent.

U. B. Bray. U.S.P. 2,031,096, 18.2.36. Separation of wax from oil, using propane and di- or tri-chlorethylene.

B. Hopper. U.S.P. 2,031,107, 18.2.36. Oil is separated from wax cakes in solvent extraction processes, using liquefied propane by blowing propane gases under pressure through the wax-cake and partly washing the wax-cakes with liquid propane.

B. Hopper. U.S.P. 2,031,108, 18.2.36. Removal of wax from oil by adding hard asphalt (of 3–5 penetration value at 77° F. and m. p. 200° F.) to the waxy oil and separating the wax from the oil. W. S. E. C.

Asphalt and Bitumen.

553.985 : 553(567)

589. Note on a Lump of Asphalt from Ur. R. J. Forbes. *J.I.P.T.*, 1936, **22**, 180–184.—An account of an analysis of a lump of asphaltic matter found embedded in the "Flood Layer" at Ur with some views on its occurrence. G. R. N.

665.521.8 : 620.17

590. Physical Properties of Asphaltic Mixtures at Low Temperatures. L. F. Rader. *Proc. Asphalt Paving Technologists, U.S.A.*, 1935.—A preliminary report is presented on an investigation of the physical properties of asphaltic mixtures at low temperatures, the results of which are interpreted with respect to the cracking and deterioration of asphalt paving mixtures. The tests used, the development of which is discussed, include the determination of: (1) modulus of rupture, (2) modulus of elasticity in flexure, and (3) toughness.

When chilled to low temperatures asphaltic mixtures under load behave similarly to Portland cement concrete, stone or cast iron, so that it is reasonable to assume that cracking is due to excessive tensile stresses caused by contraction. Methods of calculating the tensile stresses produced in asphaltic mixtures by temperature reduction are described, but it was felt that transverse tests were more satisfactory than tension tests. Compacted moulds of asphaltic concrete $8 \times 2 \times \frac{1}{2}$ in. were prepared and cooled for 2 hours in a solid CO_2 refrigerator, being finally tested transversely at air temperature, the necessary corrections being made. The moulds were clamped horizontally and a vertical load was applied at the centre, increasing at the rate of 0·05 in. per minute, and deflection at the centre of the beam measured until a load of 400 lb. was reached. The elasticity in flexure is calculated from the load-deflection readings and the modulus of rupture from the load required to break the mould.

From the standpoint of reducing cracking it is desirable to have a low modulus of elasticity and a high modulus of rupture. The index of toughness is given by the area under the load deflection curve, being a measure of resistance to repeated shocks. For the same ultimate strength, the shock resistance decreases as the modulus of electricity increases, whilst for the same modulus of rupture value the modulus of elasticity may be taken as the index of toughness. However, for mixtures of different modulus of rupture values it is not practical to interpret toughness from the modulus of elasticity values. To determine the toughness of mixtures at low temperatures the Page Impact Test was used. The results of tests on a series of moulds of a sheet asphalt mixture of different types are given, and it is concluded that increasing density of mixture due to improved compaction greatly increases the value of the modulus of rupture, but has little effect on the modulus of elasticity. Compaction is important to develop good tensile strength at low temperature. The tendency of sheet asphalt is to become more brittle at low temperatures, particularly with insufficient asphalt content. Further tests on sheet asphalt prepared from Mexican asphalts of varying penetrations indicate that as the normal penetration is decreased, stability at low temperatures is appreciably increased, the modulus of elasticity is greatly increased, and the modulus of rupture is slightly increased. The toughness is practically constant for the mixtures containing 68 and 48 pen., but is decreased for the mixture containing asphalt of 16 pen. C. L. G

665.521.8 : 620.17

591. Ductility at Low Temperatures. W. H. Flood. *Proc. Asphalt Paving Technologists, U.S.A.*, 1935.—In view of the fact that most asphalts used in paving have ductilities at 77° F. in excess of the limits of the machine, tests at lower temperatures, *e.g.* 32° F., 39·2° F. and 41° F., have been in use and are specified in some places. The difficulty of maintaining low temperatures and the small variation in ductilities obtained have led to the author's selecting the temperature of 60° F. as being more easily maintained, and near the critical point of rapid change in ductility. Tests on a series of samples of asphalts show that the variations in ductility at 60° F. were twenty times those at 39·2° F. Those with higher sulphur contents show higher ductilities than those with lower sulphur contents. It is shown that a frequently used specification (ductility at 39·2° F. to be not less than one-tenth of the penetration

at 25° C. minus one) is unsound, as 40/50 pen. asphalts have less difficulty in meeting it than 50/60 pen. asphalts. Also, the results of the ductility test at 39·2° F. are so close and of such small magnitude that slight variations within the experimental error of the test have an unreasonably great effect. The repeatability tests at 60° F. are stated to be less than 3%. The use of the ductility at 60° F. is recommended for further study. C. L. G.

665.521.8 : 620.16

582. The Fluidity Factor Test. J. Zapata. *Proc. Asphalt Paving Technologists, U.S.A.*, 1935.—In view of the lack of tests to determine the durability of the bitumens used for highway work, attention is turned to the fluidity factor test, the concept of which is based on the possibility of connecting the properties of the asphalt with those of the crude from which it comes, bearing in mind Abrahams' statement that the weather-resisting property of asphalt is greater the more asphaltic the crude.

The fluidity factor is analogous to the viscosity index in lubricating oils in giving an indication of the type of crude from which the asphalt is prepared. The viscosity temperature curves are sufficiently typical to supply this information, but the rate of change of viscosity is more emphasized in the fluidity factor, which is measured by $F.F. = (V - P)\frac{P}{100}$, when V = Visc. S.F./135° C. and P = pen. at 25° C. The results of a series of tests on batches of refinery asphalts and road oils indicated the variations in different batches from the same refinery, but clearly showed when a change of crude was effected. The test has been criticized because (1) it depends on the measurement of a physical characteristic which is subject to too much variation, (2) the character of the material can be changed to show better fluidity than it would actually have, (3) the fluidity factor is not a function of the character of the crude, and (4) that even if it were, values can be obscured or radically changed by blending. It is felt, however, that some fluidity test analogous to the lubricating-oil viscosity under test is required, even if the present factor needs modification. C. L. G.

665.521.8 : 546.22

583. The Sulphur Requirement in Asphalt. V. Nicholson. *Proc. Asphalt Paving Technologists*, 1935, p. 71.—In view of the insertion of the sulphur clause in a number of asphalt specifications, laboratory tests have been carried out on a variety of asphalts with a view to determining whether there is any correlation between the sulphur content and other characteristics. Little information is available as to the nature of the sulphur compounds, but there is obviously no free sulphur present. Those in Trinidad and Bermuda asphalts are different from those in petroleum asphalts, as the former give off H_2S on heating. The tests carried out include: (1) the German hardening test (temperature at which penetration under a 450-grm. load is 1), the difference between which and the m. p. gives an indication of the plastic range of the asphalt, (2) the asphalt constant (derived from difference in m. p. of an asphalt mortar and that of the asphalt), (3) fluidity test, (4) Oliensis spot test, (5) float test, (6) usual asphalt tests.

It is shown that of all the 18 asphalts tested, every homogeneous asphalt with sulphur content (S) less than 3% shows less than 130 fluidity factor ($V - P \times \frac{P}{100}$ where V = visc. S.F. at 275° F. and P = pen. at 77° F.). Those with S greater than 3% showed a float test above 190 secs. All asphalts except a Texas and a Californian with $S < 3{\cdot}0\%$ showed an S.G. $< 1{\cdot}02$ at 60° F. and those with $S > 4{\cdot}64$ showed an S.G. $> 1{\cdot}035$. No general correlation between S and ductility at 32° F. could be drawn, with the exception that those asphalts with $S > 4{\cdot}75\%$ showed better ductility than those containing less S, this not being entirely due to lower susceptibilities of such asphalts. In contrast to the asphalt examined, two samples of Trinidad oil asphalt and Venezuelan asphalt with S of $> 3{\cdot}0\%$ were tested, both showing fluidity factors of < 130, the Venezuelan having a much lower ductility at 32° F. than the Trinidad. The Californian asphalt showed the highest cementation value, although the high sulphur asphalt also showed up favourably. Some of the domestic asphalts showed better solidification point figures than the Mexican. The high sulphur asphalts on the whole showed greater increases in m. p. on the addition of filler, and thus higher

stabilities, than did the lower sulphur asphalts. In general, it is concluded that the sulphur content, if over 3%, has an influence on the viscosity properties (float test and fluidities). Reference is made to the paper presented by Dr. C. Mack before the Association in 1933, showing that if the oily constituents of an asphalt content contain more than 5·2% of sulphur, it will disperse the asphaltenes to a much greater degree than the oily constituents which are non-aromatic in nature. C. L. G.

667.13

504. Applications, Properties and Preparation (by Hot Processes) of Bituminized Paper. E. B. Hoffmann. *Bitumen*, 1936, **6**, 34–36.—Bituminized paper of various types is prepared by passing the paper over heated rollers immersed in hot bitumen, the temperature being thermostatically controlled. Excess bitumen is removed by scrapers. Impregnation by hot processes is more complete than by cold processes, as in the former case the bitumen penetrates into the voids between the paper fibres. The paper can be made perfectly airtight and waterproof.

In certain cold processes where bituminous emulsion is added to the paper pulp, the water being removed from the sheets by vacuum, the paper may be damaged by the suction. The presence of precipitating agents may also impair the quality of paper prepared by this process. Only soda cellulose can be used for the hot process, as this will withstand the high temperatures (140–150° C.) required to make the bitumen thin enough for impregnation. Sulphite cellulose is brittle and hard at 90° C. The applications of the finished paper include: packages for chemicals and manures, packing for machinery parts, coating of cables, etc. C. C.

667.634.17

505. Bituminous Paint Materials. H. Walther. *Oel u. Kohle*, 1936, **12**, 191–194.—The behaviour of asphaltic bitumens (blown and H.V.) and coal-tar pitch under conditions of use as protective coatings is discussed.

The usual physical tests give some indication of the mechanical stability and plastic properties of the film. Blown asphalts, which are characterized by a large difference between Fraass breaking point and softening point (K–S), yield paint films which will withstand mechanical shock, but coal-tar pitch, having a small K–S/Fraass range, is more brittle and more sensitive to changes in temperature. Adhesion to metal immersed in water is greatest in coal-tar pitch and least in blown asphalt; in this connection it is stated that good results are obtained if an undercoat of C.T. pitch is followed by a coat of asphaltic bitumen. After 420 hours' exposure to daylight the three materials in question were essentially unchanged when kept *in vacuo*. In dry oxygen crinkling occurred in all cases, the asphaltic bitumens showing an increase of 2% in weight. In all cases the "benzole-insoluble" increased. In moist air or O_2 both bitumens evolved volatile acidic products, the proportion of which increased with the severity of exposure to light; experiments are described which show that the acidic product could cause corrosion of metal. This weathering effect occurred most readily in blown bitumen and was absent in C.T. pitch.

P. G. H.

625.752

506. Adhesivity in Theory and Practice. W. Riedel. *Asphalt u. Teer*, 1936, **36**, 119–124, 191–194.—A general survey is given of the significance of adhesion between bituminous binder and stone in road construction, with a number of references to the literature. This is followed by a discussion of various comments which have been published on the author's methods of measuring adhesivity. C. C.

665.521.8 : 539.61

507. Adhesion in Relation to Bituminous Road Materials. A. R. Lee. *J.S.C.I.*, 1936, **55**, 23T–29T.—The general characteristics of adhesives and of adhesive processes are considered, and the results of an investigation of the wetting and adhesive properties of road binders described. Measurements were made of the contact angles of various binders in the presence of water on polished glass plate, and the effect of immersion in water of films of binder on polished glass, polished and unpolished

aggregates and on aggregates having various degrees of wetness was examined. The effect of precoating stone with cement and the effect of weathering of binder coatings were also investigated. Details of methods and materials employed are given. It is shown that moisture content and surface texture of the aggregates are the predominating factors affecting wetting and adhesive properties of binders. A. O.

625.7 : 620.16

598. Laboratory Investigations of Slipperiness of Roads. R. N. J. Saal. *J.S.C.I.*, 1936, **55**, 3–7.—The factors involved in the phenomena of skidding of vehicles on road surfaces are discussed and details given of an apparatus designed for laboratory investigation of slipperiness. Results obtained on various types of road surface under different conditions are tabulated. A. O.

665.521.8 : 678.049

599. Physical Properties of Rubber–Bitumen Mixtures. W. S. Davey. *J.S.C.I.*, 1936, **55**, 43–48T.—Details are given of an investigation of methods of incorporating rubber into bitumen and properties of the mixtures. The materials employed were as follows: fluxed Trinidad Lake asphalt, Trinidad Lake asphalt and asphaltic bitumen, asphaltic bitumen, each having an original penetration of 45, and the mixtures prepared by dissolving rubber in hot bitumen, adding latex to bitumen and evaporating the water by heating and by dissolving rubber in a petroleum flux and mixing the "rubber flux" with hot bitumen. Properties determined were penetration, twisting and elasticity and softening point. It is concluded from this work that raw rubber even in crumb form is difficult to dissolve in bitumen; when heated at 140° for 20 hours much of the rubber remains in suspension, but at 160° solution of 9 parts of nitrite crumb rubber in 100 parts of bitumen can be obtained; above 170° C. homogeneous solutions of disintegrated crepe and other types of crumb can be prepared. Solutions can be satisfactorily prepared by dissolving rubber in a flux and adding the rubber flux to bitumen, whilst latex can be dispersed in bitumen; but the removal of water may be troublesome. The addition of rubber to bitumen, when not overheated, increases the penetration, softening point and elasticity; the properties of the mixtures are, however, modified by the period and temperature of heating. A. O.

665.521.8 : 668.3

600. Patents on Asphalt. K. Kell and W. H. Schmitz. E.P. 443,287, 24.2.36. Production of wax-free asphaltic bitumen from crude oils or residues containing asphalt and wax. Liquid aliphatic ethers and esters are added to the oils before the actual treatment in order to avoid simultaneous precipitation of "soft" asphalt with the asphaltic resins. The solution is cooled and filtered using vacuum filters.

C. P. McNeil and S. A. Montgomery. U.S.P. 2,032,546, 3.3.36. An apparatus is described for the oxidation of asphalt. W. S. E. C.

Special Products.

615.778.753

601. Use of Lubricating Oil as Insecticide. C. Z. Webb. *Oil & Gas J.*, 6.2.36, **34** (38), 30.—Specifications of the California Department of Agriculture for five grades of spray oils to be used in the manufacture of oil insecticides are given. The methods to be employed in determining the distillation range, percentage of unsulphonated residue and rate of evaporation of such oils are described. Analyses of some typical oils of each grade on the market in California are given, and show that oils in the same grade may vary appreciably in viscosity and gravity, depending on the stock used for their manufacture. The oils are the basis of all citrus spray oils, and have proved successful in the control of citricola, black scale, red scale, red spider, purple, San Jose and yellow scales. Entomologists are not agreed as to any specification that would meet the requirements of an ideal oil spray, so that there are over 190 different types on the market. Efforts are being made to effect standardization and reduce the number of oils.

Spray oils are sold as tank mix, soluble oil and emulsion. The emulsifying agent and spreader is added by the spray operator when tank mix is purchased. The emulsifier generally used consists of approximately 25% steer blood albumen and 75% Bentonite, and a satisfactory emulsion is obtained on agitation when 1 to 2% of oil is added to water with the necessary quantity of emulsifier. Soluble oils contain emulsifying agent, often glyceryl oleate or triethanolamine, added by the manufacturer. They are becoming popular owing to their convenience and the claims made for them regarding penetration control and a minimizing of danger of fruit and trees. Emulsification with water is readily obtained. Aluminium naphthenate is often added for penetration control. Marketing of quick-breaking emulsions which contain about 15% water, emulsifying agent and spreader, is tending to decline owing to danger of separation on storage, etc. This type of spray is more efficient than a stable emulsion, since when a drop of spray falls on a leaf, for example, the globules of oil instantly rise to the surface and a high percentage of oil is deposited as the drop rolls off.

In the summer season of 1934 approximately 2½ million gallons of spray materials were sold in Southern California for use on citrus trees. R. A. E.

615.778.75

602. Distillate Sprays Used to Kill Dandelions in Blue Grass. Anon. *Oil & Gas J.*, 13.2.36, **34** (39), 40.—Kerosine and similar petroleum distillates when sprayed on blue grass lawns at the rate of 200–300 gallons per acre have been found under favourable conditions to kill dandelions with only a temporary effect on the blue grass. Sprays applied in cold weather in May and October had a 95–100% dandelion control, whereas those applied in the warmer months showed lower figures (down to 63%). It is not clear whether the stage of development of the dandelion or the atmospheric temperature is the more important factor, but the latter is more probable. Cool, rainy weather in the spring or autumn is recommended as the best time for spraying. Only water-white products freed from unsaturated hydrocarbons should be used, yellow, unrefined or excessive quantities of distillate having an injurious effect on the grass. The distillate penetrates the leaves and moves slowly downward, eventually killing the roots, a month sometimes elapsing before the plant dies. C. L. G.

66.062.6 : 608.3

603. Patents on Special Products. Chemical Works, formerly Sandoz. E.P. 442,198, 4.2.36. Preparation of sulphuric esters of high molecular alcohols containing more than 8 carbon atoms by treating the higher alcohol first with sulphonating agents; the mixture is then treated with polyvalent alcohols containing 2–6 carbon atoms.

547.279.3

J. Y. Johnson. E.P. 442,607, 12.2.36. Manufacture and production of organic sulphur compounds, *e.g.* ethane dithio-ethers, by treating vinyl thio-ethers of mono- or poly-valent mercaptans with aliphatic or aromatic mono- or poly-valent mercaptans.

665.542.55 : 608.3

Naam. Venoot. de Bat. Petr. Maat. E.P. 443,263, 25.2.36. Preparation of alkenes with at least 5 carbon atoms in the molecule and/or derivatives by refining a fractional distillate of the cracked products obtained by cracking normally non-gaseous hydrocarbon mixtures preferably in the vapour phase.

547.53-933

E. I. Du Pont de Nemours & Co. and I.C.I. E.P. 443,361, 26.2.36. Manufacture of alkali metal addition products of aromatic hydrocarbons by allowing an alkali metal, *e.g.* sodium, to react with a hydrocarbon of the naphthalene series at temperatures between − 80 and + 50° C. in the presence of a polyether or a mixture of such ethers if necessary in an inert diluent.

661.763 : 608.3

Krebs Pigment and Colour Corpn. E.P. 443,470, 28.2.36. Preparation of dispersible carbon black which is particularly useful in the manufacture of printing ink, varnish and lacquers. An alkaline-earth metal naphthenate is precipitated in the presence of carbon black in an aqueous medium at elevated temperatures.

66.095

J. C. Bird. U.S.P. 2,035,112, 24.3.36. New products which are free from sulphonates, soluble in benzole, carbon tetrachloride, etc., and in hydro-formed solvents of kauri butanol value of 40, and insoluble in aqueous alcohol are obtained from acid sludge of asphaltic and mixed base oils. These products are used for staining and dyeing wood and for surface coating compositions.

547.269.2 : 608.3

J. Y. Johnson. E.P. 442,525, 10.2.36. Manufacture of organic sulphur compounds of the type $R{\cdot}SO_2{\cdot}R_1$ or $R{\cdot}SO{\cdot}R_1$ where R is an alkenyl group, R_1 an alkyl group containing at least 6 carbon atoms or a cyclic radical, by reacting at 150–160° C. alkenyl sulphones or sulphoxides with compounds containing at least one nitrogen atom attached to one or more hydrogen atoms. Diluents may be employed, *e.g.* toluene, and sometimes a catalyst, *e.g.* alkali or alkaline-earth metals, etc.

66.095.13 : 608.3

Carbide and Carbon Chemicals Co. and T. F. Carruthers. E.P. 442,643; 12.2.36. Production of esters of 2-butyloctanol by heating the alcohol with a carboxylic acid or its anhydride preferably in the presence of an esterification catalyst (sulphuric acid). The esters are used as plasticizing agents in the lacquer industry.

547.789.6 : 608.3

Wingfoot Corporation. E.P. 442,954, 19.2.36. Preparation of dithiazyl disulphides by oxidation of 1-mercaptobenzothiazole with hydrogen peroxide. W. S. E. C.

Engines and Engine Testing.

621.434

604. Experimental Bench Testing of Petrol Vehicle Engines. C. O. Beale. *J. Inst. Aut. Eng.*, 1936, **4** (5), 35–51.—This paper describes the progress of a typical car or commercial engine through its bench tests from the point of view of performance prior to the design being passed for production.

The author first shows how the performance which should be achieved can be arrived at, presuming the engine is of conventional type, and explains how the mixture loop is obtained for a given engine by plotting specific fuel consumptions against torque as the mixture is weakened with throttle and speed constant. The next part of the paper deals with engine examination before test to determine valve lift curves, etc. A table is also given which shows relative gas velocities in different parts of the induction system which have been found to give success in service. The actual bench testing is dealt with very fully under four main headings, viz. General Considerations, Initial Tests, Tests to Find Cause of Poor Performance and Final Tests. The first item deals with surrounding layout of exhaust system, water system, control of oil temperature, air temperature, fuel and dynamometer, and engine accessories. The next item describes the method of obtaining power curves, motoring losses, mixture loops and optimum ignition settings. The third item shows how faults in performance can be located and corrected, such as low power, thermal, or volumetric efficiency. In the final section the author describes how (if power output and consumption are satisfactory) such important matters as compression ratio, fixed carburettor setting and adjustment of automatic ignition advance are best determined before the engine can be considered ready for road test. C. H. S.

621.317.755

605. Timing Base Equipment for Cathode-Ray Tubes. R. R. Batcher. *Instruments*, 1936, **9** (2), 38.—Most oscillographic work having previously been done with galvanometer type instruments in which all measurements are made with respect to time, the cathode-ray oscillograph finds many similar demands made upon it. The various oscillograms obtained with timing waves of various shapes when a sine wave is applied to the other pair of deflection plates are shown. The methods of producing the timing wave electrically are discussed, and the problem of providing a suitable charging rate for a capacity and its solution by the use of a vacuum tube is dealt with. Motor-driven timing bases may be used for low frequencies, and a relay arrangement is

also useful in such cases, and may be made to provide an easy method of synchronisation with the frequency under investigation. Neon tubes have been frequently adapted for the provision of the timing circuit, but they suffer from disadvantages, which may, however, be overcome by the use of a thyratron. P. D.

621.43.01

606. Indicating High-Speed Engines. *Diesel Engine Users Association*, No. S, 127.—A record is given of the verbal discussion contributed by Messrs. A. F. Evans and W. R. Groves, Dr. F. Postlethwaite, Messrs. E. M. Dodds, G. B. Fox, J. L. Chaloner, R. Stansfield and A. W. Rowe and Dr. S. J. Davies. In addition, the written contributions from Mr. E. S. L. Beale and Messrs. Dobbie, McInnes and Clyde, Ltd., are given.

The discussions were mainly confined to indicators using a cathode-ray oscillograph, but balanced pressure types were also mentioned. Various types of pressure element are described, including carbon piles, composition piles, composition blocks, the electromagnetic pick-up and piezo electric crystals. The advantages and disadvantages of these systems are freely discussed.

Various methods of controlling the horizontal movement of the cathode-ray stream in the oscillograph are described, and in some cases it is shown how this horizontal scale may be calibrated in terms of time, crankshaft degrees or piston displacement.

Methods of calibrating the pressure scale are dealt with by several of the speakers.

The applications of each particular indicator are dealt with, and in many cases these are not confined to pressure diagrams, but can be extended to diagrams of rate of change of pressure, valve movements, valve velocities, etc.

The following proprietary indicators are described: The Cossor Electronic Indicator, the Dodds Indicator, the Standard Sunbury indicator and the Dobbie McInnes-Farnboro' indicator. J. G. W.

621.434 : 621.436

607. Some C.I. Engine Problems. G. Amery. *Engineer*, 1936, **161**, 307–309, 328–329.—The author considers the ideal constant-pressure cycle, and indicates how the fuel should be injected to obtain this form of combustion. It is shown that with the jerk pump system of fuel injection these conditions cannot be met in practice. Owing to the existence of the delay period before commencement of combustion, part of the fuel charge burns more or less at constant volume, and shows an appreciable departure from the ideal cycle. In addition, since it is impossible in practice to close the fuel valve instantaneously, fuel is injected too slowly during the time taken for the fuel valve to close, and in consequence the pressure falls below the constant-pressure value.

The process of combustion of an oil droplet is examined theoretically, and it is shown how the physical and chemical properties of the fuel and the engine conditions may affect the delay period.

Certain observed phenomena in engines are accounted for by suitable theory, which includes the supposition that the delay period is a function of the spray velocity. The author suggests a form of apparatus which might be constructed to verify this point. J. G. W.

621.436

608. A.E.C. Marine Oil Engines. Anon. *Shipbuilding and Shipping Record*, 1936, **47**, 319–320.—This firm has been producing marine engines for propulsion and auxiliary requirements for the past three years, and this article is a description, with illustrations, of the types built for propulsion under Lloyds Register survey and B.O.T. requirements.

Two types of four-stroke high-speed diesel are supplied, a 6-cylinder of 8·85 litres developing 100 B.H.P. at 1650 r.p.m., or for high-speed craft this engine can be supplied to deliver 125 B.H.P. at 2000 r.p.m. Similar engines are also built with four cylinders. The A.E.C.–Ricardo combustion chamber is used throughout. C. H. S.

621.436 : 621.43.056

609. Fuel Combustion Adjustments of Diesel Engines. J. Lamb. *J. Inst. Mar. Eng.*, 1936, **48**, 37–42.—An article dealing with the causes and remedies for the troubles

most likely to be encountered in the operation of the fuel system of both air and airless injection diesel engines. With regard to the most common trouble experienced with the latter system, viz. the formation of carbon on the nozzles, the author states that, contrary to general belief, it is most often caused by too high a degree of atomization. This means that the fuel droplets have low penetration, and too much of the charge will burn in the vicinity of the nozzle, causing overheating, and although the pump cut-off is very rapid, the last of the charge enters the cylinder at much-reduced pressure, and this part of the charge carbonizes on the overheated nozzle. This has no ill-effect if the exhaust remains clear until the build up of carbon begins to interrupt the spray.
C. H. S.

621.436

610. **Diesel Engine Development.** Anon. *Oil & Gas J.*, 27.2.36, **34** (41), 40.—A history of the development of engines of the diesel type is given, together with indications of the present trend in its design and applicability, and of the part which the oil industry has played in the development of the diesel engine. C. L. G.

Economics and Statistics.

33.01 : 665.5

611. **The Oil Industry and the World Crisis.** J. B. A. Kessler. *J.I.P.T.*, 1936, **22**, 113–117.—An address to the London Students' Branch, indicating the effect the Great War, over-production, and the management of the monetary and credit system have had on the oil industry. G. R. N.

665.5 : 66(47)

612. **Petroleum Industry in U.S.S.R. The Vostoconeft and Prikamneft Trusts.** I. Ganitzki. *Mon. Petr. Roum.*, 1936, **37**, 207–210.—The basin of the River Bielaia forms the principal region of the Vostoconeft Trust. This was recognized as petroliferous in 1769 by Lepekhin, but it was only in 1929 that the eruptive well "V. Tshussovskie Gorodky" re-created interest in this region. Explorations under Blokhin were successful over the period 1929–1932, and the Ichimbaevo field was developed. This contains two domes, one on each side of the River Bielaia. Other fields in this region are Allagouvatovo, Smokaevo, Tura-Taou, etc. In the latter are found a great number of so-called "chikany," *i.e.* calcareous layers which form distinct horizons sometimes on the surface and sometimes at depths up to 1135 metres. Some of these layers contain crude in workable quantities. Since 1934 the Ichimbaevo–Allagouvatovo region has been linked with Oufa by a railway of about 160 km. Production in the field has risen from 4600 tonnes in 1932 to 100,000 tonnes in 1935. The total reserves of the Trust are estimated at 400 million tonnes.

The Prikamneft Trust was formed in 1929, and controls the region around the River Tshussovia. In 1935 there were 30 wells in production and 70 exploratory wells, whilst 12,300 tonnes were produced in 1934. A second field near the village of Levchino was discovered in 1933, whilst in 1934 the Krasnokamsk field was discovered by accident, a well bored for water producing petroleum. This field is considered to have reserves totalling 70 million tonnes. The crude here is very viscous and contains little gas. The paper concludes with some notes regarding the fields situated around the River Oukhta basin. This was re-explored in 1930, and the crude gives 20% spirit, 14% kerosine, and 40% gas oil. Production was 40,000 tonnes in 1935. A second field was discovered in 1932 on the River Iarega. The crude is 0·950 gravity, viscous and asphaltic. The total reserves of the Prikamneft Trust are estimated at 120 million tonnes. W. E. J. B.

665.5 : 66(47)

613. **Petroleum Industry of U.S.S.R.** I. Ganitzki. *Mon. Petr. Roum.*, 1936, **37**, 275–279.—*Anticipated Gasoline Exports in* 1936. During the course of the first five-year plan (1928–1932) the export of gasoline from the U.S.S.R. almost doubled, reaching 2,017,554 tonnes in 1932. Throughout the second five-year plan (1933–1937) the exports of petroleum, particularly gasoline, are falling, *e.g.* in the first eleven months of

1935 only 573,809 tonnes of gasoline were exported. This fall is not due to a fall in production, since, for example, in 1935 25,200,000 tonnes of crude were produced. The programme for 1936 anticipates the production of 30 million tonnes of crude and gas, with a gasoline production of 3,920,000 tonnes, which will probably be attained. The diminution in exports of gasoline is due to the increasing home market, which has risen from 94,300 tonnes in 1928 to about 2,400,000 tonnes in 1935. Increasing numbers of agricultural tractors, lorries and cars have been responsible for this increase. In addition, the increasing production of gold no longer makes necessary the export of gasoline at any price. It is estimated, therefore, that gasoline exports will be much lower in 1936 than they were in 1935.

Cracking in Gasoline Production. Various measures designed to replace part of the home gasoline consumption include the development of diesel engines, producer gas engines using charcoal, benzole-recovery plants, hydrogenation of coal and increasing numbers of natural gasoline plants and cracking plants. The last-named is the most important project, and by the end of 1936 the total capacity of 45 cracking units will be 6½ million tonnes of charging stock per annum. This will include 14 units concentrated at Saratov, with 2¾ million tonnes capacity per annum. W. E. J. B.

665.5 : 66(47)

614. Petroleum Industry in the U.S.S.R. I. Ganitzki. *Mon. Petr. Roum.*, 1936, **37**, 441–443.—Prior to 1914 almost all primary distillation apparatus, including that for lubricating-oil production, consisted of batteries of stills arranged for continuous distillation according to the method evolved by Mendelejev. The annual capacity of the refineries for such distillation was, in 1913, about 7 million tonnes, of which about 93% was treated at Baku and Grozny. Over the period 1914–1919, the total production of crude fell from about 9 million tonnes to 4½ million tonnes, whilst the quantity treated at Baku and Grozny fell from about 6 million tonnes to about 2½ million tonnes. The War and internal trouble led to the refineries being neglected and partly destroyed, so that in the years 1920–1923 the total annual capacity for distillation was reduced to about 3 million tonnes. From 1922 onwards reconstruction and new construction took place, such that by October 1, 1928, the treating capacity was about 9½ million tonnes per annum. During the first five-year plan 32 distillation units were built, with a total capacity of 14 million tonnes a year, whilst by the end of 1935 about 25 million tonnes represented the annual capacity for primary distillation, and about 21½ million tonnes were treated. During 1936 the first stage of the refinery at Oufa will be constructed, whilst the refinery at Orsk will near completion. This will add about 2½ million tonnes a year capacity to distillation equipment. Recently more attention is being paid to the quality of products for the home market, and at the end of 1935 47 large refineries with 32 pipe stills and 30 batteries of stills for continuous distillation were located in seven principal centres, viz. Baku, Batum, Grozny, Touapse, Krasnodar, Gorky and Orsk. Of these Baku has 12 pipe-stills and 16 batteries, and Grozny 9 pipe-stills and 7 batteries. Decentralization will occur during 1936 and 1937, and refineries will be constructed in the interior of the country. These will add about 17½ million tonnes per annum capacity to the pipe-still equipment; thus a total capacity for primary distillation of about 45,000,000 tonnes a year will be attained, possibly by 1939. W. E. J. B.

625.1 : 665.5 : 66(498)

615. The Railways and the Petroleum Industry in Rumania. I. Miclescu. *Mon. Petr. Roum.*, 1936, **37**, 267–273.—This article reviews the above subject from many angles, and presents much statistical data regarding the quantities carried in various years and the cost of same. It is pointed out that at the present day the economic life of the country is based on the petroleum industry, and not, as was formerly the case, on agriculture. The author suggests that the present position of the petroleum industry and the railways could best be solved by a railway tariff which was based on railcar quantities, irrespective of distance or quality of the product freighted. Another suggestion is the provision of a special institute to direct the petroleum industry in dealing with the complicated economic problems which face it.

W. E. J. B.

665.5 : 66(498)

616. Consumption of Petroleum in Rumania. *Mon. Petr. Roum.*, 1936, **37**, 175–181.—Rumania, with about 19 million inhabitants, exports about 80% of its refined petroleum production. The home consumption, which is given for each month of the year for the period 1926–1935 under the categories of essence lourde, essence auto, kerosine, gas oil, "combustible special," lubricating oils, paraffin wax, coke and asphalt, totalled about 1,480,000 tonnes in 1935. Very little increase (12%) is noted over the 1929 figure. This is attributed to the fiscal charges which petroleum products carry in this country. A table of these charges indicates that for 1935, 57·7% of the sale value of the products represented taxes, 13·2% transport charges, whilst the balance, 29·1%, represented the value to the refineries. Another table traces the evolution of the taxes which fall under various categories. Some of these taxes have been increased many times, *e.g.* in the case of lubricating oil from 500 lei per tonne in 1926 to 13,000 lei per tonne in 1935. A further table shows the contributions made by the various organizations operating in Rumania to the total of home-consumed products for the year 1935. W. E. J. B.

381: 622.62

617. Trends in Inter-Fuel Competition. R. S. McBride. *Chem. Met. Eng.*, 1936, **43**, 14–16.—The demand for better processing efficiency because of inter-energy competition creates new chemical engineering fuel problems. As a result of this demand the share of energy supply contributed by coal or solid fuel is steadily diminishing. Petroleum and natural gas as suppliers of energy are on the increase, and in this connection the light-fuel-oil market is becoming competitive to the motor-fuel market. Natural gas is used by public utilities companies where it can be pumped economically. The domestic and semi-industrial use of butane, etc., is also increasing. An important competitor of fluid fuels, particularly gas, and a serious one of coal is hydro-electric power, but while the latter is near its theoretical peak of efficiency, gas is at a very low figure. G. R. N.

341.225 : 614.777

618. Pollution of the Sea by Oil. Anon. *Petr. World*, 1936, **33**, 10–12.—The draft convention prepared by the League of Nations Committee, who have been studying the question of the pollution of the sea by oil, is given. G. R. N.

631.56 : 665.5 : 65(861)

619. Petroleum Industry of Colombia, 1935. *Bol. Minas y Petroleo, Bogotá*, 1936.—The following data are among those given for the six-month period, January–June 1935: Total footage drilled, 78,175 ft. Crude petroleum produced, 8,624,819 brl.; delivered to pipe-line, 7,926,951 brl.; received at Mamonal terminal, 7,832,442 brl.; loaded on to tankers at Mamonal, 8,272,644 brl.; shipments (exports), to U.S.A., 2,084,339 brl.; Italy, 175,954 brl.; Aruba (D.W.I. refinery), 2,585,273 brl.; Canada, 1,190,962 brl.; France, 1,378,006 brl.; Norway, 35,654 brl. The total exports of crude petroleum over the period were 7,450,188 brl., of a total value of U.S. $7,575,344·54. The amount of crude oil treated at the Barrancabermeja refinery was 731,137 brls.

The natural gas treated amounted to 8,939,840,000 cu. ft.; lost in treatment, 2,093,416,000 cu. ft.; used as fuel, 2,161,117,000; returned to structures, 4,685,307,000 cu. ft. The natural gasoline produced was 11,734,670 U.S. gallons, or an average of 1·31 gallons per 1000 cu. ft. of gas.

The total number of wells in existence at the end of June 1935 was 715, of which 34 were closed down. The total number of persons employed in June was 890, as compared with 1097 in January 1935. Of these 97 and 88, respectively, were foreigners. L. O.

REVIEWS AND BOOKS RECEIVED.

Reviews.

629.123.94

THE TANKER IN PRACTICE. L. R. Anderson and L. H. Morrison. Liverpool: Charles Birchall & Sons, Ltd. 245 pp., 43 figs. 10*s.* 6*d.*

THE literature of the Petroleum Industry is not rich in works dealing with tank vessels and their cargoes and "The Tanker in Practice" should be welcomed by those interested in this subject.

The first chapter, in introducing the reader to the subject, portrays life on board, and outlines the advantages awaiting those who decide to serve in this branch of the Mercantile Marine; it deals with the various products carried, and describes the more common tests applied in their examination. Twenty pages of this chapter are devoted to measurement of oil, description of instruments, specimen calibration table, co-efficients of expansion, factors for making temperature corrections to specific gravities, examples of how cargoes should be calculated, capacity tables for pipe-lines of various diameters, and data dealing with the inter-relation of units in the Imperial and United States of America systems.

Chapter II describes the construction of various types of tank vessels, and the reader can obtain a good working knowledge of the vessels described.

The authors have gone into a considerable amount of detail in regard to pumping arrangements and operations (Chapter III) and loading, discharging and ballasting (Chapter IV), which should be of real value to ships' officers. The glowing tributes paid to automatic measuring gauges in the latter chapter will be read by many who have had less fortunate experiences of them.

In Chapter V "Fire" has been dealt with very comprehensively and successfully, and the reader must gain valuable knowledge from the subject-matter contained therein.

Chapters VI and VII deal, respectively, with "Cleaning and Gas Freeing of Tanks" and "Corrosion." These chapters are characterized by a sound knowledge of the subjects.

The work is not entirely free from errors. On page 20 the constants for approximately correcting specific gravities are not those usually accepted, and the authors would have been better advised to have referred the constants to descriptions of grades of oil rather than to specific gravities. The method used in the example given on pages 20 and 21 is inaccurate, because, if the "list of gravity coefficients—values given for 1 degree rise, or fall of temperature" are actually factors to be used for this purpose, then they should not be multiplied by the specific gravity as stated at the bottom of page 20. At the bottom of page 25 it is stated that 6·4093 U.S. barrels are equal to an English ton. Probably this is a misprint, and should be 6·4039 U.S. barrels to the long ton. On page 28 "Saybold" should read "Saybolt."

"The Tanker in Practice," after careful perusal, cannot fail to impress. Those who are well versed in the subject will conclude that the book is carefully written as a result of considerable practical experience. W. F. JELFFS.

336.119: 665.5: 66(46)

LE MONOPOLE DU PÉTROLE EN ESPAGNE. J. Grandel. Paris: Librairie Technique et Économique. viii + 197 pp. 1935. 25 fr.

Spain is one of the few countries to-day where the petroleum industry works under a rigid government monopoly which controls, either itself or through subsidiaries, every ramification, from exploration for crude-oil deposits to the retail sale of the refined products, and Dr. Grandel's account of the activities of this monopoly cannot fail to interest those who study the wider aspects of the oil business. It may be commended, also, to those who wish to acquire an insight into the Spanish character and its reactions to "big business," provided they do not allow themselves to be mesmerized by the eloquence of the author.

The book opens with what amounts to a history of Spanish economics, and discloses a penetrating understanding of Latin idiosyncrasies which, surprisingly enough,

appears to be lacking in a later section in which he criticizes the Monopoly for its failure to reach the almost unattainable ideals which it set itself.

The book is divided into four parts headed: "Before the Monopoly"; "Creation of the Monopoly"; "General Aspect of the Monopoly"; and "The Monopoly and the Spanish Liquid Fuel Policy." These titles are sufficiently descriptive to indicate the scope of the work, and it may be added that the treatment is thorough. While the volume is not overburdened with tables, the data are adequate and to the point, and a bibliography is included. The style is exceptionally light for a treatise of this nature, and the reader's interest is held, except where there are lapses into unnecessary repetition.

The author relishes neither the attitude and actions of the oil trusts nor those of the Spanish Government, and he resents, as might be expected, the sacrifice of French interests, although he makes clear that the domestic industrialists, lacking the benefit of protests from foreign chancelleries, were more badly treated.

After nearly eight years of existence, the Monopoly and its subsidiaries have failed to accomplish much of the objects of the decrees which brought them into existence, but the failure has been more in detail than in general. Anyone who has motored in Spain will endorse the opinion expressed of the quality of the "Gasolina" supplied, and of the inadequacy, both in numbers and amenities, of the roadside filling-stations. A knowledge of the conditions prior to the Monopoly, however, and of the opposition with which it had to contend, inclines one to be less severely critical than the author of the shortcomings which are so obvious to observers from the outside.

Of the Monopoly, it may be said with considerable truth, as was said of the gear-box: "*C'est brutal, mais ça marche.*"

Whether it accomplishes its ambitious programme, or whether it fails, it will have put up a fight as courageous against obstacles as difficult and abuses as real to it as did the immortal hero of Cervantes, who, after all the vicissitudes through which his country has passed, still mirrors the soul of Spain as none other can do. I am left with the impression that, among the executives of the oil world, the only ones who read "Don Quixote" in the original are the Russians. LAUNCELOT OWEN.

66

ANNUAL REPORTS OF THE SOCIETY OF CHEMICAL INDUSTRY ON THE PROGRESS OF APPLIED CHEMISTRY, Vol. XX, 1935. London: The Society of Chemical Industry. 814 pp. 12*s.* 6*d.* (7*s.* 6*d.* to members of Society of Chemical Industry).

To all those interested in the trend of application of present-day chemistry this volume must have an appeal all its own. The modern "Reports," like those of our own Institution, have widely departed from the form they once had. They are now in nature critical and less mere records of publications; more continuous and informative to those specializing in allied branches of science or industry and less assumptive of previous knowledge; in fact, true summaries with more than a hint of the value of the work described and its probable future development. Each one of the twenty-five sections is a readable description, though suffering of necessity from the limitations of space and time. At any rate, twenty-four are, and the reviewer is more than willing to assume that the other, that on colouring matters and dyes, is not so abstruse as it appears to him.

It is not possible, of course, to "review" this book in the accepted sense of the word. Its contents are staggering in their summation of one year's human achievement in one single branch of applied science. From the chemistry of the vitamins and hormones to the work on synthetic rubber; from the section on Iron and Steel to that on Photographic Materials, the volume is fascinating in the feeling it gives of putting one in touch with the latest word in applied chemistry, even if that word may not be completely understood. In that way the book has also a saddening effect, because it makes it so clear that there is all too much one would really like to know, might reasonably grasp and possibly even participate in, which must remain outside or only on the outermost fringes of one's ken.

Of the sections of particular interest to the Petroleum Industry that on Mineral Oils naturally first attracts attention. Mr. Goulston, who was also last year's reporter, has again done a good job. The survey is well arranged. Starting with a discussion of the important and omnipresent subject of Corrosion (one, by the way, which may

be commended to the Institution as basis for what should be an attractive meeting), it passes from the Crude Oil and Natural Gas to consideration of individual products. Perhaps the most interesting divisions, which are also the most extensive, are the allied subjects of Motor Spirit and Anti-knock and Combustion. The amount of work recorded on these subjects is a clear indication that the death-knell of the petrol engine is far from having been sounded, despite the big advances made in the use of the high-speed pressure-ignition engine. It is significant in this connection that Mr. Goulston gives only four citations on the subject of fuel for high-speed diesels, and one of these is from the *Daily Telegraph*.

The page or so devoted to an account of the Chemical Derivatives of Petroleum does not leave the impression that much progress has been made in this field during the year.

In the section on General Plant and Machinery, Messrs. Richards and Vowler pay appropriate attention to the work emanating from Nash and his co-workers on the principles underlying the design of plant for solvent extraction. But taking it all through, the outside technological world does not appear to think that much intrinsically new has happened during the last year relative to oil plant as distinct from that for hydrogenation. Incidentally, whilst discussing the use of phenolic resins, reference is made to their application in bubble-caps and trays. We are certain to hear more and more of the use of plastics as materials for such uses.

Most of the section on Fuel is devoted in one form or another to coal. The only reference to the alleged antagonism between Coal and Oil appears in the statement that the tax on imported fuel has been responsible for over 1,000,000 tons more coal being consumed. This represents an appreciable proportion of the 6·5% increase in coal production for the year.

Hydrogenation and the Fischer synthesis provide the chief bridge between petroleum and the ever-growing Gas, Carbonization, Tar and Tar Products interests reported by Messrs. Hollings and Voss, although there is general discussion of the use of tar as a fuel. This is largely based upon the 14th Report of the Secretary for Mines.

Amongst the other sections some attention, but not very much, has been paid to the problem of textile (fibre) lubrication. The chief references are to the minimizing of electrification and the improvement of spinning and weaving of rayon.

There are also many matters of special interest to the petroleum technologist in the sections on Oils, Fats and Waxes, Solvents and so on; but it is not by reason of direct association that the "Reports" are recommended for perusal. Their catholic interest must appeal to all who are engaged in the application of science to industry, and the writer in particular is grateful for the opportunity of their close perusal.

S. J. M. AULD.

Book Received.

665.5 : 65(73)

American Petroleum Institute :

PROCEEDINGS 16TH ANNUAL MEETING.

Section I General Sessions. Contains the Address by the President, Mr. Axtell J. Byles, and the Annual Reports to the Board of Directors of the Divisions of Production, Refining, Marketing, Accident Prevention, Public Relations and Statistics.

Section II Marketing. Contains the first Progress Report of the Automotive Survey Committee and papers on "The Rating of Aviation Fuels," "Volatility," "Characteristics of I.C. Engines when Operating with Butane–Air Mixtures" and the "Marketing of Petroleum Products."

Section III Refining. Contains important papers on Lubricants and Lubricating, Polymerization and High-Speed Diesel Engine Fuels.

Section IV contains the Report of the Committee on Drilling Practice on "Improvements in Drilling Technique Equipment during 1935," and of various technical committees dealing respectively with Valves, Rig Irons, Pumping Equipment and Sucker Rods. The volume also contains the paper by Deussen and Leonardon on the "Use of Electrical Logs for Correlation in the Gulf Coast of Texas and Louisiana." Abstracts only are included of the remaining papers presented at the four group sessions, but they will be published in full with discussions in the annual cloth-bound publication of the division : *Drilling and Production Practice*, 1935.

ABSTRACTS.

	PAGE
Geology	232 A
Geophysics	242 A
Drilling	244 A
Production	247 A
Pipe-Lines	248 A
Corrosion	249 A
Gas	251 A
Crude Oil	252 A
Physical Chemistry	252 A
Chemistry of Petroleum ...	254 A
Analysis and Testing	256 A
Refining and Refinery Plant ...	257 A
Cracking	259 A
Hydrogenation	262 A
Polymerization	263 A
Motor Fuels	264 A
Lubricants and Lubrication ...	268 A
Fuel Oil	270 A
Asphalt and Bitumen	270 A
Special Products	272 A
Engines	273 A
Coal and Shale	274 A
Economics and Statistics ...	274 A
Reviews, Books Received, and New Periodicals	276 A

AUTHOR INDEX.

The numbers refer to the Abstract Number.

Abele, R. P., 649
Adams, C. E., 707
Albright, J. C., 655
Anderson, J. A., 707
Andreev, I., 693

Backus, H. S., 667
Bahlke, W. H., 694
Bailey, J. R., 685
Barker, R. W., 622
Baron, Ch., 636
Bartholomew, F. J., 683
Bataafsche Petroleum Mij., 639, 707, 716
Batcher, R. R., 718
Beck, H. V., 654, 656
Beck, Koller & Co., 698
Benedict, W. L., 673
Bent, F. A., 715
Berezlavsky, E. V., 704
Bertram, E. A., 665
Blau, L. W., 639
Blum, W., 658
Bowles, V. O., 670
Brandes, O. L., 679
Bratton, A. C., 685
Brenner, A., 658
British Thomson-Houston Co., 663
Burk, R. E., 707

Calingaert, G., 676
Carbide & Carbon Chemicals Corpn., 716
Carpmael, A., 663
Carruthers, T. F., 716
Chave, C. T., 687
Chebotar, L. P., 704
Chemical Construction Corpn., 662
Cisancourt, H. de, 635
Clark, W. L., 649
Coutts & Co., 707
Cramer, P. L., 675
Crick, C. S., 649
Curtis, H. A., 707
Cuthill, J., 640

Dalyrymple, D., 634
Davis, W. N., 706
Deutsche Hydrierwerke A.-G., 716
Dons, E. M., 694
Dorey, S. F., 683
Dreyfus, H., 663
Dryer, C. G., 700
Du Pont de Nemours & Co., 704

Eberle, W. A., 707
Egerton, A. C. G., 704
Egloff, G., 673, 678, 700, 701

Faragher, W. F., 694
Farrington, B. B., 706
Felsing, W. A., 685
Fenske, M. R., 690, 707
Footner, H. B., 650
Fraser, W. M., 690
Frey, F. E., 698

Gee, G., 696, 697
Geisler, D. W., 712
Gemant, A., 666
Gilliland, E. R., 670
Goldsby, A. R., 677
Goodyear, G. H., 677
Green, W. G., 659
Greenfelder, B. S., 707
Groote, M. de, 664
Gross, H. H., 707
Grosse, A. V., 674, 704
Gruse, W. A., 679, 704
Gunness, R. C., 670

Halbouty, M. T., 644, 645
Hancock, W. T., 694
Hargrove, G. C., 694
Haringhuizen, P. J., 660
Hartley, A. C., 657
Herthel, E. C., 694
Hille, H., 709
Horn, W., 649
Houdry, E. J., 694
Howe, H. V., 631
Hsieh, T. Y., 671
Huff, L. C., 694
Hurd, C. D., 677
Huston, R. C., 671

I.G. Farbenindustrie A.-G., 695, 698
International Hydrogenation Patents Co., 696
Ipatieff, V. N., 674, 704
Ivy, J. S., 632

Jackson, T. H., 690
Jacksel, J., 711
Jacob, P., 695
Jacobs, D. L., 694
Jacobsen, A. E., 681
Jakosky, J. J., 638
Johnson, E. W., 639
Johnson, F., 707
Johnson, J. Y., 663, 716
Jones, L. D., 707
Jones, R. A., 632

Kane, W. G., 621
Kassell, L. S., 672
Keiser, B., 664
Keith, P. C., 694
Kellum, L. B., 629
Kiss, H., 661
Kleinert, H., 712
Klinkman, G. H., 713
Krumbhaar, W., 698

Lacey, W. N., 665
Lane, W. C., 643
Legé, E. G. M., 704
Leighton, P. A., 669
Levine, I. M., 694
Leverson, A. I., 623
Lewis, W. K., 690, 694
Lindike, H. F., 707
Liston, J., 719
Livermore, G. P., 642
Livraghi, E., 704
Lowry, A., 679
Lowry, C. D., 700

MacCubbin, A. A., 721
Manley, R. E., 707
Martin, W. H., 720
Maur, B., 704
McCluer, W. B., 707
Mercier, M., 634
Metallgesellschaft A.-G., 663
Meyers, S. L., 646
Migaux, L., 637
Mills, B., 643
Mond, A. L., 704
Moore, W. F., 694
Morrell, J. C., 673, 694, 700, 701
Mortensen, R. A., 669
Mulligan, M. J., 675

Nelson, E. F., 694
Nelson, W. L., 692
Non-Poisonous Gas Holding Co., 663

O'Neill, F. E., 649
Overbaugh, W. V., 707
Owen, J. E., 639

Parks, G. S., 668
Parrish, C. I., 678
Pew, A. E., 704
Pfau, G. M., 694
Philip, H. E., 649
Pier, M., 695
Pitzer, M. B., 649
Poole, W. G., 684
Potts, H. E., 695
Pratt, O. G., 694
Pruitt, H. H., 694
Putschkow, P. W., 689
Pysel, D., 694

Ragatz, E. G., 704
Rideal, E. K., 697
Ritchie, A. V., 694
Roberts, J. K., 694
Robertson, D. W., 681
Robertson, L. H., 707
Rolfe, R. T., 654
Ruhrchemie A.-G., 704
Ruthruff, R. E., 698

Sage, B. H., 667
St. Cair, S., 723
Santillán, M., 630
Scheineman, F. W., 707
Schmidlin, J., 653
Schneegans, D., 635
Sclater, K. C., 647
Seguy, J. D., 694
Shaw, S. F., 653, 653
Simon, W., 695
Sineres, J. de, 637
Skin, W. L., 649
Slotnick, M. M., 639
Smiley, T. F., 651

Smith, A. D., 694
Smith, C. L., 694
Smith, E. R., 650
Sneiger, D. S., 641
Société de Prospection Électrique, 639
Société Française de Catalyse General, 716
Scrocs, H., 676
Standard Oil Development Co., 694, 707
Statham, L., 639
Steinrath, H., 661
Stellwaag, A., 710
Stevens, A. H., 716
Stevens, D. R., 704
Stoll, F. R., 649
Strausser, P. W. C., 638
Strevens, J. L., 706
Startevant Engineering Co., 663
Sullivan, F. W., 693, 707
Swindell, F., 648
Texaco Development Corpn., 707
Thomas, H., 704
Todd, S. S., 668
Trescott, L. C., 680
Tropsch, H., 678
Trow, R. F., 694
Tucker, R. P., 714
Tuttle, M. H., 707
Universal Oil Products Co., 704
Vandover, J. R., 649
Vermeulen, T., 667
Vivian, A. C., 657
Wade, A., 636
Wagner, H. W., 663
Walker, C. L., 649
Walther, H., 669
Was, D. A., 660
Watson, C. B., 694
Watson, C. W., 694
Weinzierl, J. F., 630
Wells, W. T., 649
Weston, C. B., 694
Whitman, W. G., 694
Wik, S. N., 715
Wilkinson, C. J., 649
Wilson, C. H., 638
Wirtel, A. F., 664
Wright, J. C., 649
Youker, M. P., 694
Zavertnik, J., 721
Ziegenhain, W. T., 639

Geology.

55(72)

620. Synopsis of the Geology of Mexico. M. Santillán. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 394–402.—The five physiographical provinces of Mexico are: (1) Central plateau; (2) Western Sierra Madre; (3) Eastern Sierra Madre; (4) Yucatán peninsula; (5) Lower California peninsula.

The oldest rocks known in Mexico are Proterozoic igneous and metamorphics occurring in the western Sierra Madre. Limited outcrops of Palæozoics are known, ranging Cambrian to Permian, but the presence of Devonian is doubtful. Mesozoic rocks were probably deposited over most of Mexico, but are not seen nearly so well on the western slope as in the east and on the Central plateau. Triassic and Jurassic occur only in relatively small areas. The Triassic shales are metamorphosed. Lower Jurassic shales and limestones are known in a number of areas, but middle Jurassic has only been identified in the vicinity of Cualac, Guerrero and Oaxaca. The upper Jurassic is more widely distributed, and in the central part of Mexico shows at least twelve divisions with distinctive faunas. The lower Cretaceous is usually interstratified with intrusives, and rests in some places on upper Jurassic, in others on Palæozoic. It is composed of limestones, shales, marls and a few marly and calcareous sandstones. Middle Cretaceous limestone is widespread, covering much of the Central plateau and the eastern Sierra Madre. Folding and faulting have induced porosity in it, which is important for oil accumulation at Tampico and Tuxpam, and has also given mineralization. The upper Cretaceous shales with interbedded sandstones contain large coal deposits.

Igneous and sedimentary Tertiary are well developed. A great thickness of interbedded marine shales and massive sandstones characterizes the Eocene of North-east Mexico. These beds have given gas. Oligocene sandy marls with thin sandstones interbedded are known in the oil-fields of Veracruz and Tamaulipas. Miocene is found in lower California, along the Gulf coast and in the isthmus of Tehuantepec. Pliocene occurs in lower California, Chiapas and Oaxaca. After the close of the Cretaceous strong folding occurred, and in the Miocene and Pliocene there was extensive igneous activity. G. D. H.

551.2 : 551(72)

621. Structural Geology of the Border Province of North-eastern Part of Mexico Adjacent to Zapata and Starr Counties, Texas. W. G. Kane. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 403–416.—Most of the anticlines in this area run N.W.–S.E., and almost all plunge S.E. The nose usually begins almost abruptly from a regularly east dipping monocline and has little or no closure on the west. Its axis is about 120° from the anticlinal axis, suggesting two sets of folding forces.

The Sierra de Picachos anticlinal uplift exposes the San Felipe and Tamasopa limestones. Its axis changes from N. 70° W.–S. 70° E. in the main Sierra de Picachos to S. 40° E. in its southerly en echelon extension in the Sierra de Papagallos. Neither of these ranges is so strongly folded as those farther west. Flanking the Sierra de

Picachos and the Papagallos Hills on the east is the very important Cerralvo fault zone. The zone of disturbance is almost 15 mls. wide, affecting formations from the Papagallos or Taylor shale to the Midway and Indio. Its northern end is explained by simple adjustments incident to the sharp folding of the Salado arch at that point. It becomes more complex from Guerrero southwards.

The Salado arch is a broad anticlinal feature at the northern end of the Rio Grande border province. It trends S. 50° E., changing to S. 35° E., where it plunges south between Tortillas and Tanque Barreta. It is expressed in upper Cretaceous and lower Eocene. Several unsuccessful wells have been drilled on this structure. The Guerrero dome is shown at the surface by Carrizo sandstone. Its western flank is intensely faulted. The San Felipe limestone was not reached by a well 7891 ft. deep. The Vallecillo anticline is a symmetrical fold in Eagle Ford or San Felipe beds. The long, plunging Aldamas anticline trends S. 50° E., changing to almost due south south of the Monterrey–Matamoras railroad. It is at least 30 mls. long. No satisfactory test has yet been made of its possibilities, the San Felipe limestone not having been penetrated.

The La Presa anticline runs N. 42° W., with a W.–E. nose on the west. The surface beds at the La Presa gas wells are about 490 ft. below the top of the Cook Mountain formation. No well has yet penetrated more than 2000 ft. of beds on this promising structure, and the lower Mount Selman, the Carrizo and the Indio formations should be accessible. The Ochoa–Pescado structure is a large, well-developed, closed anticline running N. 30° W. with Yegua beds at the surface. Three wells have shown oil and gas without commercial production. The important Zacate fault seems to have a downthrow of 1000 ft. to the east. Several gas wells and a small oil well in the Queen City formation have been drilled on the small Roma anticline. The small Pancherias structure has about 110 ft. of closure and cross-faults. Middle Jackson beds are at the surface, and the first well showed commercial gas, and at times oil, in every sand from 90 ft. to a total depth of 1271 ft. G. D. H.

552.582 : 552(72)

622. Micropalæontology in Mexico with Special Reference to the Tampico Embayment. R. W. Barker. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 433–456.—The history of the investigation of micro-fossils in this area is described briefly.

The Tuxpam (lower Miocene) is a shallow-water, transgressive formation with a poor and contaminated micro-fauna. The characteristic species are Cristellaria vaughani and Rotalia beccarii. The Mesón is mainly a shallow-water series, but has a fair proportion of marls. Its fauna is variable, separation from the Tuxpam being easy, but it is not so readily distinguished from the underlying Alazan. The lower part of the Alazan has a fauna indicatjve of warm seas of moderate depth, and the upper part, with a predominance of species of Uvigerina, indicates deeper water. The Mesón and Alazan are Oligocene.

The upper Chapapote consists of grey marls with sandy parts and at times thin sandstones. It is characterized by Anomalina dorri and Rotaliatina mexicana. The lower Chapapote has Hantkenina spp., and its facies points to deposition in still, deep water. The Tantoyuca is the near-shore equivalent of the Chapapote.

The Guayabal (Tempoal) formation has a rich micro-fauna with Nodosaria mexicana, Eponides guayabalensis, Cristellaria mexicana, Discocyclina perpusilla and Ceratobulimina eximia. The Aragón is representative of deep water, its marls carrying Hastigerinella eocænica var. aragonensis, Anomalina dorri var. aragonensis and Hantkenina mexicana var. aragonensis. The Chapapote, Guayabal and Aragón constitute the Eocene.

The Chicontepec shows a marine transgression and deposition in shallow water. Its micro-fauna is poor, and distinction from the overlying and underlying formations depends mainly on negative evidence. For the most part the Velasco is a deep-water deposit. Its age is not quite certain, but there seems to be an important faunal break between the underlying Mendez and the Velasco. The Mendez (upper Cretaceous) fauna includes Globotruncana area, Cibicides excolata, Bolivina incrassata and Gumbelina excolata. Most of the species are pelagic.

A bibliography of over 140 references is appended in addition to a chart showing the ranges of some 231 species of foraminifera in the Tampico embayment.

G. D. H.

553.982

623. Petroleum Geology and the American Association of Petroleum Geologists. A. I. Levorsen. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 387–392.—An address by the President of the Association at the mid-year meeting in Mexico City, October 16, 1935.

In 1859, when the first oil well was drilled, geologists began to correlate the occurrence of oil with geological phenomena, but it was only between 1910 and 1920 that petroleum geology began to come into its own. To-day in the U.S.A. the exploration for oil and gas is almost entirely under geological supervision, composed of a wide variety of specialists. Initially the search was for anticlines and domes by surface geological mapping. In 1924 geophysics began to come to the assistance of the geologists by indicating the underground geological structure, which up to then could only be vaguely estimated from examination of well cuttings and of very crudely kept well logs. About this time the difficulty of obtaining satisfactory cores out of drilling wells was overcome. In the opinion of the author the next forward step is for the geologist, the geophysicist and the stratigraphist in combination to develop a technique which will enable them to discover oil-fields of the overlap or sand lens type, such as East Texas, Burbank and similar fields. There may come an end some day to favourable local structure, and then there will be the need of oil-fields more closely related to stratigraphical variation than to pure structural anomalies. In 25 years the petroleum geologist has evolved from the position of a novice or meddler to that of an indispensable factor in the crude-oil-producing industry. The executives of nearly all large oil companies in the U.S.A. are now geology conscious. B. F. N. M.

553.982 : 553(611)(64)(65)(672)(691)

624. Search for Petroleum in the (French) Colonies. M. Mercier. *Bull. Assoc. Française T.P.*, 1936, **34**, 9–26.—A lecture dealing with the progress of exploration for petroleum in Morocco, Algeria, Tunis, Equatorial Africa (Gabon and Loango) and Madagascar.

Of the overseas French possessions, Morocco is the first where prospecting for petroleum has been carried out on a large scale. This is due, in some measure, to the fact that indications of petroleum have been known there from the earliest times. The place-name *Zeft* (= *Neft* in the Orient) is significant.

The Moroccan Rif is divided, geologically, into the High Rif (composed of Jurassic and Palæozoic strata), the Middle Rif (chiefly Jurasso-Cretaceous black schists) and the outermost, or Pre-Rif. The actual oil seepages are almost completely confined to the last-named, which consists of low-lying marly ground of a very complex nature, pierced at points by Jurassic hills. The seepages occur, usually, along lines of faulting rather than at definite geological horizons. They have been described in the Miocene (Gharb), the Nummulitic or Cretaceous (Gharb, Ouergha-Sebou) and in the Lias (Prérif) or Trias. Bituminous schists, mostly Cretaceous, are known to occur in the Atlas region.

Some drilling was started, by private enterprise, in 1919, but systematic work was not undertaken until 1929, with Government aid. Traces of oil, and even small production, have been encountered at various geological horizons, notably in the Lias, the Eocene and the Miocene. Prospecting is now being carried out in the Gharb and the Prérif. In the Gharb, the beds studied may be Miocene resting on Flysch, Cretaceo-nummulitic with a diapyr core of Trias, or Flysch bordering outcropping Cretaceous beds. Sixty wells have been sunk here, varying from 100 m. to 2138 m. in depth.

At Djebel Tselfat, in the Prérif, a shallow petroliferous horizon is being tested in the Lias. Six wells have been sunk since 1929, from 80 to 1700 m. in depth. Drilling has been done at Djebel Bou Kennfoud, and is in progress at Djebel Bou Draa, Djebel Outita and Djebel Ari, while geological and geophysical work continues throughout the region. At Djebel Tratt, near Fez, drilling is about to start. Near Fez, also, at Piton Bellot, a well has penetrated a Miocene dome to a depth of 900 m., but without successful result. At Tiseroutine, in Taza, a seepage of very light oil occurs in a complex of Eocene–Cretaceous folds, and geological studies and some shallow drilling have been accomplished. One well has reached a depth of 700 m., but the work is now suspended. The first real encouragement was obtained when the well "Tselfat 26" gushed in 1926.

Since that date, activity has been redoubled, and a great number of wells have

tested, in particular, the Lias, Eocene and Miocene beds, but without bringing assurance of any commercial production.

In Algeria, shallow drilling was done as far back as 1874, at Aïn Zeft. The prospectors were attracted by seepages, and were without technical guidance.

A new impetus was given when the Pearson group, after geological studies, drilled nine deep wells on anticlinal structures in the Chélif valley region. These wells, sunk from 1913 to 1923, gave negative results.

At Tliouanet, after the discovery of seepages in 1896, drilling took place in 1898, and continued to 1902, but revealed nothing except insignificant traces of oil. In 1916 a well of 900 m. was sunk, in beds of Helvetian age, without result; while drilling on the site of the old work at M'sila resulted in production from a depth of 167 m. In 1918, at Medgilla, a little to the north, a similar horizon was struck. In all about a hundred wells have been drilled, of which forty have been producers.

In Tunis the petroleum indications are clear, but not numerous. They are restricted chiefly to zones of isoclinal folding at Aïn Rhelal (Helvetian), Sloughia (Helvetian) and Kef Bou Debbous (Cretaceous). Pitch occurs in various formations. The first drilling took place in 1909, without useful results. Systematic work was commenced in 1931 with a study of the Miocene beds at Sloughia and Aïn Rhelal. At Sloughia, detailed geological, and some geophysical studies showed that the axis of the structure consisted of the Trias massif of Djebel Djebs; this massif is flanked to the east by Miocene, and to the north by Cretaceous beds. Four wells have been sunk in marly beds (Miocene) which transgress directly on the Trias and show slight indications of petroleum.

At Aïn Rhelal very complete geological studies indicates that the Miocene was folded into a regular anticline, possibly complex, and this was confirmed by geophysical studies. Work here is suspended. The Cretaceous beds at Kef Bou Debbous are now in the course of examination.

In North Africa the dry climate leaves the surface free of vegetation, and allows the study of the complex geology in detail. In Equatorial Africa, on the other hand, the geology is simple, but obscured by forest.

The sedimentary basins of Gabon and Loango flank the crystalline and Palæozoic shield of Central Africa. The beds, as far as they have been studied, have suffered only slight dislocation, and transgress gently on the Palæozoic basement. Folding has been recognized at various points, but the dips rarely exceed 6 to 10 degrees. On the dome of Madiela, a well was stopped at 445 m. in 1934, after showing traces of oil. A second well has now reached a depth of 800 m.

In Madagascar thirteen wells were drilled, in the Maroboaly–Folakara region, between 1909 and 1917, by various English and South African interests; no results were obtained, but it should be pointed out that the wells were located on geologically unfavourable sites. Systematic geological studies have since been carried out, under Government auspices. The Andrafiavelo anticline (near Maintirano on the west coast) has, in 1933 and 1934, been tested by two wells. They struck volcanic rock at 300 and 427 m., respectively, the results being of more geologic than commercial interest.

As in Equatorial Africa, the transgression of the sedimentary beds on the igneous mass is gentle; dips rarely exceed 3 or 4 degrees. Further studies are now being made, and a location has been fixed at Folkara, where the derrick is in course of construction.

The paper is illustrated by maps of the drilling areas in Morocco, Tunis, Equatorial Africa, and Madagascar, and by graphs showing the comparative drilling activities by private and governmental interests, year by year, in Morocco (private, 1918–28; Government, 1929 to Oct. 1, 1935) and Tunis (private, 1909–27; Government, 1932 to Nov. 11, 1935). L. O.

553.982 : 553(64)

625. Note on the State of the Search for Petroleum in Morocco at the End of 1935. *Bull. Assoc. Française T.P.*, 1936, **34**, 27–29.—At the beginning of 1935, the work accomplished indicated vast possibilities of petroleum in the Lias limestones. It is now necessary only to reach this reservoir, particularly where the seal has not been eroded, in order to determine if the oil found at Tselfat was casual or indigenous.

It can be stated, from the provisional results achieved during 1935, that the local stratum of Tselfat is limited in extent and lenticular.

The work over the wider area strongly suggests, however, that there exists a petroliferous horizon of considerable extent in the Lias.

The total meterage drilled during 1935 was about 9500; it would have been 10,500 but for delays due to accidents. The solution of the Moroccan oil problem calls for fairly deep wells, and 4000 to 6000 m. of drilling, per structure examined, should be arranged as a minimum. The five structures being explored thus require a drilling programme of at least 25,000 m. If, out of 20 wells, one only discovers a commercial oil-field, the result must be considered highly satisfactory. L. O.

553.982 : 553(64)

626. Petroliferous Strata of Morocco. Ch. Baron. *Bull. Assoc. Française T.P.*, 1936, **34**, 30–36.—It can happen that work, beyond the scope of the funds which private industry will invest, is of real national interest. Such is that of the search for petroleum in Morocco. That country imports annually petroleum and its products to the value of 110 to 120 million francs.

Private enterprise searched for oil in Morocco from 1917 to 1928, without tangible result. To-day, with governmental aid, after five years of geological studies aided by thousands of hand-dug pits, after twelve months of torsion balance work, twenty months of electrical resistivity measurements, more than 30,000 m. of drilling, and an expenditure of 75 million francs, it is still impossible to estimate the value of the petroleum deposits.

A similar state of affairs exists in French Equatorial Africa and Madagascar.

The fact that Well Ts. 17, in March 1934, produced 250 tonnes of oil a day, although it was drilled on a much-raised and very broken structure, raises hopes of results of value under more favourable conditions. In the region of Petitjean–Meknès there are more than twenty favourable structures. Without daring to advance even hypothetical estimates, we may assume a productivity of 2500 tonnes per hectare in suitable structures, which, over four square kilometres, would produce a million tonnes. In the above-mentioned region alone, this area is exceeded three or four times.

L. O.

553.982 : 553(64)

627. Petroleum Research in Morocco. L. Migaux. *Rev. Petr.*, 23.5.36 (684), 737–738.—This is a publication *in extenso* of the official Report on the exploration work undertaken in French Morocco. From the end of 1929 to the beginning of 1934 the Government exploration had been mainly topographical, stratigraphical, tectonic and geophysical, entailing the drilling of some 25,000 metres. Then in March 1934 the Tselfat "eruption" put an end to the pioneer work, and a more serious drilling programme was initiated with the object of discovering new oil-bearing strata and recurrences of the Tselfat oil horizon in French Morocco. Before starting systematic development, it was necessary to establish that an oil horizon or horizons existed which could supply Morocco's consumption requirements (about 150,000 tonnes/annum), otherwise a necessary local refinery could not be economically put into operation. Exploitation on a commercial scale necessitated an initial production at the rate of 150,000 tonnes a year, with a calculated reserve of 2 to 3 million tonnes.

The Tselfat oil horizon has been tested by six wells representing 2800 metres of drilling, and has been found to be small, very broken and flooded by sulphur water; but, though this is discouraging, it has shown that this limestone is capable of furnishing an oil reservoir, and is perhaps a guide to finding other petroliferous strata, better covered, less shattered and not depleted by seepages. Besides the Tselfat work, after 6 months' preliminary geophysical examination, up to January 1936, 10,000 metres have been drilled in six completed and six drilling wells, in an attempt to find the Tselfat limestone horizon better covered and less broken. These are in three groups: (1) Those which sought the limestone from the anticlinal crests near Petitjean, Meknès and Fez. The first well struck a fault at 1080 metres without reaching the limestone, but obtained a heavy oil at 180 metres. A second well is drilling at 850 metres, and two others are still drilling. (2) Wells seeking the limestone at depth on the faulted flanks of the above folds. (3) Wells trying to discover the limestone under a younger unconformable cover of Cretaceous beds. As three-quarters of the surface of North Morocco is of this nature, these discovery wells are

most important. Besides these operations others have been started to explore: (1) The levels below the productive limestone; (2) the Tertiary sandstones of the Rharb; (3) the study of the middle Atlas, and (4) of the Rharb plain. The three last have at present only geological and geophysical exploratory importance, but more or less significant traces of oil have been found. But, briefly, no definite result has been obtained. There is much yet remaining to be done. To be sure of having seriously probed all the problems set, 50,000 metres more drilling must be done. Another aspect of the main problem is National Defence. If Morocco possesses oil reserves capable of supplying even partly the needs of the capital, it is vital to know it, and the Government is sufficiently interested to supply ample funds for this work, so that two new powerful outfits, in addition to the three large and two medium-sized outfits already in use, can be acquired and assigned to Morocco.

B. F. N. M.

553.982 : 553(642)

628. Search for Oil in Spanish Morocco. Anon. *Rev. Petr.*, 9.5.36.—An intensive examination of Spain with the object of finding oil has been, and still is, in progress, and results recently obtained in French Morocco incited two geologists, Fallot (French) and Marin y Beltrau de Lis (Spanish), to explore the protectorate of Spanish Morocco. This article is an extract from their very detailed memoir. Three geological zones are described.

The Mediterranean coastal zone is formed of a succession upward from very old gneisses to Permian beds, the predominant rock of the area being an argillaceous group, relatively soft with even surface, which gives to the landscape a gentle undulating profile.

Farther inland is the Rif Cordillera Zone, following a bend from the Straits of Gibraltar to Punta Pescadores. The Rif Cordillera is formed of Triassic dolomites of the Alpine series up to the Jurassic, and in the flexurings appear Cretaceous and Eocene deposits. The calcareous phase is predominant with varied magnesia, causes very pronounced relief to the mountains, so that peak Kelti rises to 2000 metres, 20 km. from the sea, but from the tectonic point of view this zone is not considered to be of interest in the exploration for oil.

The external zone is formed by Secondary and Tertiary rocks. An argillaceous marl predominates. It contained minute fossil organisms. Cretaceous, Eocene and Oligocene formations were identified from fossil evidence. French geologists believe that Jurassic beds should also be found in this Spanish zone. Sandy groups of Cretaceous, Eocene and Oligocene intercalate or overlie the marls. In this zone the expectation is that oil will be found, because the conditions appear to agree with the French studies in their territory at Djebel Tselfat and Zoco de Arbaa, at the former of which a production of 60 tonnes a day has been proved, and lately another well has given 15 tonnes a day. The oil is thought to seep up from the Trias and come in the fissures of the dome limestone. At the latter place oil has been found in the Tertiary sandstones, and is believed to have risen to the higher beds by way of fractures due to diapiric uplift. Work in the French territory is being reproduced in the Spanish part, with the object of identifying the Tertiary beds of the Atlantic zone and of making a deep exploration of the Jurassic series.

B. F. N. M.

553.982 : 553(72)

629. Palæogeography of Parts of Border Province of Mexico Adjacent to West Texas. L. B. Kellum. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20** (4), 417–432.—During Jurassic and Neocomian times the southern margin of the North American continent extended across Northern Mexico into California, with a peninsula covering most of the state of Coahuila. The sea transgressed northwards on this, and the overlap relationships of the Jurassic and Neocomian sediments are seen on the margins of the land mass. This pre-Aptian peninsula was formed of Palæozoic and pre-Palæozoic rocks. There was probably a gulf or re-entrant on its eastern side, and it is likely that the Pacific and Atlantic were connected across Northern Mexico during certain parts of Neocomian time.

Throughout much of Southern and Central Coahuila the Aptian–Albian deposits are characterized by a gypsum facies (part of the Cuchillo formation). Thick develop-

ments of gypsum are also known in North-eastern Chihuahua, but it is not yet settled whether these were connected with those of Southern and Central Coahuila, or whether they represent a distinct lagoon. These lagoonal conditions arose as the Cretaceous sea spread slowly northwards across the low-lying lands of the North American continent.

Structurally, Southern Coahuila and Eastern Durango show three divisions: (1) The central province of broad, gentle folding includes the great brachyanticlines of Sierra de la Paila, Sierra de Alamitos and Sierra de Garcia on the east, and Sierra del Venado, Sierra del Sobaco, Sierra de Tlahualilo, Sierra de Campana, etc., on the west. (2) North-east of the central province is the eastern province of strong folding. It includes Sierra de la Fragua, Sierra de San Marcos and Sierra de la Purísima in the north-east, and Sierra de Rosalia, Sierra de Patula and Sierra de la Gavia in the south-east. The long, asymmetrical, steeply folded anticlines trend N.W.–S.E. (3) The southern province is a zone of pronounced cross-folding in the Sierra Madre Cordillera, having a width of about 75 mls. It can be subdivided into the geosynclinal Parras basin in the north and a geanticline in the south.

The Coahuila peninsula is regarded as the chief cause of the prominent zone of cross-folding which lies to the south, extending across South Coahuila and North Zacatecas. Its first diastrophism is correlated with the Appalachian revolution. In the Trias or middle Jurassic there was volcanic activity in the seas to the south-west. The second major folding was in the Laramide revolution, beginning early upper Cretaceous, and in the upper Cretaceous the sea withdrew from the Parras basin trough also, exposing the whole cordilleran province. In the Eocene there was intense folding, succeeded by intrusion and locally by normal faulting in the middle Tertiary and onwards. Volcanic activity was renewed in early Pliocene. G. D. H.

553.982 : 553(76)

630. Possibilities of Shoreline or Shoestring Fields on Texas–Louisiana Gulf Coast. J. F. Weinzierl. *Oil & Gas J.*, 16.4.36, **34** (48), 155.—All the salt domes in this region may be regarded as the piercement type, and differ only in the depth at which they have come to rest. The source of the salt is undoubtedly very deeply buried, and the cover may be divided into two portions: (*a*) the lower and more dense rocks as yet unknown because of their extreme depth, and (*b*) the upper crust composed of formations commonly met in borings and those that may be encountered when drilling machinery is able to reach much greater depths. When a line of weakness was developed in this cover, up which plastic salt began to flow, the intrusion went straight through the lower portion of the cover until it entered the upper portion, where, owing to the less compacted state of the sediments, it was able to spread laterally and form an intrusion similar to a volcanic batholith. A further suggestion is made that some of the shallow domes may be merely secondary intrusions from deeply buried "batholiths" of salt due to later movement along a line of weakness developed after the main salt movement.

If these "batholithic" intrusions took place when the comparatively recent sediments were being laid down, the consequent bulging in the sea floor would cause a local shallowing, or even an island. Sand lenses or the thickening of a sand-bed on the edges of these protrusions would result, and would form ideal traps for petroleum.

The many oil sands, the possibilities offered by the known salt domes, and the likelihood of much deeper production on the edges of salt "batholiths," are said to make this region one of the richest known oil territories in the world. J. A. G.

553.982 : 553(763)

631. Louisiana Petroleum Stratigraphy. H. V. Howe. *Oil & Gas J.*, 16.4.36, **34** (48), 98–111, 124.—The northern shore of the Gulf of Mexico is probably the landward side of the largest growing geosyncline on the North American continent. Between 30,000 and 40,000 ft. of shore-line sediments have been laid down, their weight depressing the northern border of the Gulf to about three times its maximum depth of 12,000 ft. Production from late Tertiary horizons may soon be possible in this zone at depths greater than this figure.

The Cretaceous fields of the north and the Tertiary fields of the south are separated by the Angelina–Caldwell Flexure. In the north the Cretaceous is relatively shallow,

and folded into the Monroe and Sabine Uplifts. In the southern part of the basin between these structures the Eocene attains a considerable thickness; it is continental in character, and almost non-productive.

The Lower Cretaceous (Comanchean) is productive throughout the whole section in various parts of the State, the Lower Glen Rose being the most prolific horizon. The Upper Cretaceous section includes the Brownstone, Tokio and Woodbine, these being grouped together. The recent discovery of Woodbine production at East Texas makes it doubtful if production in North Louisiana, formerly ascribed to this sand, is correct.

The Tertiary thickens considerably to the S.W. and dips S.E. at 100–200 ft. per mile. A large structure east of the Mississippi is very similar to the Angelina–Caldwell Flexure region, and is termed the Mobile–Tunica Flexure. North of it the Tertiary dips coastwards at 20–35 ft. per mile and the beds thicken enormously. This area has not yet proved productive, but further work may find favourable structures.

The Midway lies unconformably over the Upper or Lower Cretaceous, according to the locality. It is usually represented by very clayey sediments, 450–700 ft. thick, which form a good cap-rock in many fields. The Sabine (Wilcox) is continental in the N.W., varying from 300 to 500 ft. It rapidly thickens southwards to 3000 ft., becoming marine; its shore-line appears to correspond with the Angelina–Caldwell Flexure.

The Claiborne Group covers most of the N.E. part of the State north of the Angelina–Caldwell Flexure and south of the latter structure it thickens from 2000 to 3000 ft. or more. Little production has been obtained from this group, but it has yet to be tested in many areas. No definite information is available regarding the Jackson and Vicksburg. Production is attributed to these formations in various fields, but reports are conflicting.

The U.S. Geological Survey consider the Catahoula Group to be Miocene. Production has been reported from these beds on the edges of salt domes at depths varying from 6000 to 9000 ft. The Middle Miocene thickens north to south from 2000 to 4000 ft., and is responsible for salt-dome production. Both brackish water and marine sediments are included in the Upper Miocene, and this is also productive around several salt domes. J. A. G.

553.982 : 553(764)

632. Interesting Features in Somerset Field, One of Country's Big Shallow Pools. R. A. Jones. *Oil & Gas J.*, 16.4.36, **34** (48), 175.—This pool lies in the Bexar and Antascosa Counties, Texas, and was discovered in 1912. The producing area trends in a N.E.–S.W. direction, and is approximately 14 miles long with a maximum width of 2 miles. The geology and structure have not been thoroughly worked out, but the general regional geology indicates an anticlinal nose plunging to the S.W., bordered on the N.E. by a great shallow basin.

Production is from sand lenses and fractured shale bands in the Navarro and Taylor formations (Upper Cretaceous). These horizons are affected by both folding and faulting, making it difficult to correlate the hundreds of well-logs available. Owing to a southerly dip of about 740 ft. in the mile, the depth to the producing horizons varies from 850 ft. in the north to 2200 ft. in the south.

The deepest test in the field proved Austin Chalk from 1567 to 2010 ft., although it is undecided if this figure includes the Anacacho Lime. Signs of oil were encountered, but an offset well specially drilled to this horizon for production failed. The Edwards Limestone occurred between 2278 and 3002 ft., but showed no signs of oil. The Glen Rose Limestone was met between 3097 and 4882 ft. Several cores of black bituminous limestone were obtained from this formation, and further tests may eventually prove production if porosity and structural conditions are favourable. From 4882 to 5361 ft. the well was in Trinity Sands, and was stopped at the latter depth in Trinity Conglomerate. Neither oil nor water was present in these sands.

Recovery in the field up to 1934 totalled over 9,500,000 brls., and present production averages 800 brls. per day. J. A. G.

553.982 : 553(764)

633. Rodessa Field. J. S. Ivy. *Oil Weekly*, 13.4.36, **81** (5), 21–28.—The Rodessa fault is now known to extend for about 40 miles in a N.E.–S.W. direction, with an

approximate displacement of 500 ft. in the Comanchean series and 200 ft. in the Upper Cretaceous. Numerous small fractures parallel or sub-parallel to the main fault have been determined. These disturbances seem to be of a very minor character, and though they affect the extent of the productive zones, they do not appear to interrupt the continuity of the reservoirs.

The oil has accumulated on the upthrow side of the fault immediately underlying the Massive Anhydrite at 6000 ft. The first producing zone is the Hill Sand, 35 ft. in thickness, composed of fine-grained sand and sandy shales. Below this occurs 80 ft. of impervious anhydrite, black shales and oolitic limestone, followed by the Caddo Levee Board reservoir. This has a total thickness of 88 ft., made up of oolitic limestone interbedded with black shales and sand. The sand occurs about 60 ft. below the top of the horizon, and varies from 0 to 20 ft. in thickness. Underlying the Caddo Levee Board horizon is another impervious zone, consisting of mottled red and green limestone interbedded with black shales. Its total thickness is 55 ft. This is followed by the Dees Horizon, which is 95 ft. thick, and is the main producer of the field. The uppermost portion of this horizon consists locally of a porous Coquina Limestone, underlain by the Dees Sand. This varies from a true quartz sand to a sandy limestone with interbedded sandy shales and has an average thickness of 15 ft.

Up to April 1936, 120 wells had been completed in the field, and total production was 4,689,000 brls. About 6500 acres may be regarded as proved oil and gas territory, with an additional 3500 acres for gas alone. General methods of drilling and production practice are discussed. J. A. G.

553.982 : 553(766)

634. Wildcat in McCurtain County Testing Possibilities in South-east Oklahoma. D. Dalyrymple. *Oil & Gas J.*, 30.4.36, **34** (50), 15.—The Bokhoma structure is a minor fold parallel to the main mountain movement near the northern shoreline of the old Cretaceous embayment. There is a gentle southerly dip, and migration is expected to have come from this direction. As the structure is a considerable distance from the Sabine Uplift, there is ample gathering ground. The Pecan Gap Chalk, and at least 3000 ft. of Cretaceous beds, are present. It is expected that the Woodbine and Trinity sands will be found at relatively shallow depths, the former consisting of fine brown sand and interbedded sandy clays, with an estimated thickness of 500 ft.

A 4000 ft. test-well is being drilled, which may be carried deeper if conditions are promising. J. A. G.

553.982 : 553(87)

635. Geology of the Petroliferous Areas of South America and the Islands of the Caribbean Archipelago. 2. Venezuela. H. de Cizancourt and D. Schneegans. *Ann. des Comb. Liq.*, 1936, **11**, 93–125.—Metamorphics are found south of the Orinoco on the margin of the Brazilian shield and in the cores of the Andean folds. The age is uncertain, but appears to be Palæozoic in some cases, and in the Barquisimeto area the Cretaceous is more or less metamorphosed in places. On the Guiana platform ferruginous quartzites of the Imataca series, possibly of older Palæozoic age, cover the metamorphics. Authentic Palæozoic is seen as the Rio Cachiri series, 600 m. thick, with a lower and middle Devonian fauna, of the Sierra Perijá, and the Mucuchachi and Mucupati (Carboniferous) series of the Sierra Mérida, at least 1400 m. thick. In both areas the transgressive Lomita series follows. It is 1000–1200 m. thick, and possibly of Permo-Triassic age. No Triassic or Jurassic is known in Venezuela.

The Cretaceous sediments reveal subsidence, and attain a thickness of 2000 m. at times. A deltaic phase was succeeded by limestone, and the basin was filled up by marls in the upper Cretaceous. There was emersion and regression in the Laramie period of folding. Local terms are used for the three main divisions: Barranquin sandstones and shales; El Cantil, Cogollo and Luna limestones; Guayuta and Colon shales. The ages of the various parts are not yet settled. The latest Cretaceous (Maestrichtian–Danian) seems to be missing.

The lower and middle Eocene show a remarkably uniform facies throughout the

Andean zone—the Aragua sandstones of Eastern Venezuela, and the Misoa–Trujillo of the lake Maracaibo area, shaly in the lower part and consisting of massive sandstones (Mirador) and even conglomerates in the upper. The thickness is 2300–2500 m. The beds following the Misoa–Trujillo are best seen in the more complete succession of Falcon state. They are as follows: Pauji shales (1000 m.) and Paloma Alta series of limestones and conglomerates, both being upper Eocene; the Aguanegra beds, subdivided into Sta. Rita conglomerates, Jarrillal shales and Churuguara beds, the last being early Oligocene. The Pecaya shales (600–700 m.) follow, and are transgressive on to Eocene in the Pedregal–Pecaya region; age, lower and middle Oligocene. The Agua Clara shale (upper Oligocene–lower Miocene; 500–800 m.) is an important oil horizon in Falcon state and the north-west Maracaibo basin, and is covered by 1000–1200 m. of Cerro Pelado cross-bedded sandstones and red or grey shales, which series may be partly continental. A discordance separates the Socorro (lower Miocene) series which attain 2000 m. in the east of the state. Next come the Urumaco series, the La Vela series and the Punta Gavilian of supposed lower Pliocene age.

Suggested correlations of the locally named beds with members of this sequence are discussed for the areas north-east, north-west and south of lake Maracaibo.

In North-west Venezuela Laramic movements ended the filling of the Cretaceous basins of subsidence, giving lagoonal and deltaic conditions corresponding to the Misoa–Trujillo. Upper Eocene and Oligocene are missing, indicating emersion. The Miocene and perhaps a little Oligocene lie discordantly on older beds.

The main structural units are: the Guiana platform, the Llanos, Caribbean Cordillera and Sierra Mérida, the Lake Maracaibo depression, Sierra Perijá, and the peninsulas of Goajira and Paraguana. The structure of the Llanos is masked by thick Pliocene and Pleistocene, but a series of N.N.E.–S.S.W. folds are known. Folds deviate to the south on the eastern edge of Lake Maracaibo, and to the north on its south or south-west edge.

The various fields are described briefly. In the Colon district south of Lake Maracaibo, the petroliferous horizons range from Miocene to Eocene. The main fields border the lake. The fields of Ambrosio–La Rosa–Lagunillas, aligned for over 50 km., exploit a monocline in which Oligocene and Miocene transgress Eocene. There are several fields in the Miocene area of Falcon state, and in eastern Venezuela, Quiriquire field produces basal Miocene oil from a very flat dome.

In the last two years exploration has been concentrated in eastern Venezuela and two wells, Pedernales and Orocual, have given production.

There is a bibliography of 102 geological and geographical references which are also summarised under general headings, in addition to 11 references to maps and 12 to the development of the fields and indications of the sources of statistics.

G. D. H.

553.982 : 553(94)

636. Western Australia Geology. A. Wade. *Oil Weekly*, 11.5.36, **81** (9), 162.—The Kimberley district forms the most northerly part of Western Australia. In the north are metamorphosed igneous and sedimentary rocks. The sea encroached in late pre-Cambrian or early Palæozoic time. Great thicknesses of Devonian limestone were formed. Uplift occurred at the end of the Devonian, but in late Carboniferous time there was another submergence. The rest of the sediments are of shallow-water origin, marine, estuarine and freshwater, ranging through the Permian into the Jurassic. The early part indicates antarctic conditions, but a warmer climate followed. The search for oil is directed to the basin drained by the Fitzroy river and its tributaries, where these later sediments lie. Early Mesozoic movements gave folds and faults running a little north of west to south of east, with a second series running almost north–south.

Weakly bitumen-impregnated Devonian coral limestones are known, and also bitumen in vesicles in basalts associated with fossiliferous Cambrian in the north-east. Numerous exploratory bores have given shows of oil. G. D. H.

Geophysics.

550.83 : 550(46)

637. Geophysical Studies in Spain. J. de Sinerez. *Rev. Petr.*, 2.5.36 (681), 643.—A great number of geophysical investigations have been carried out in Spain under Government control. Since 1927 the Spanish Government had led the way in undertaking officially the organization of such work. Under the direction of the Geological Institute of Spain, tests have been made by electric, gravimetric and magnetic, and seismic methods. The number of trials by the various methods is given, and it is claimed that all the results of completed investigations have agreed extraordinarily well and two confirmation drillings were a complete success. A brief account of the work done in several districts is given, and in most cases where the exploration has been completed the geophysical work forecasts have checked up well with the actual boring results. Among instances of success are: the discovery of very many faults, an artesian water source at a depth of 1500 metres, the position and depth of faulted Cretaceous domes (which led to the suspension of costly drilling), the discovery of salt formations (indicated to be at shallow depth), an oil show proved to be originating from a Miocene bed overlying a crystalline substratum (thus determining the unlikelihood of the oil show being of commercial value), and the determination that, on both sides of the Straits of Gibraltar, the strata met with down to 500 metres continued in correlation to a depth of 1000 metres. B. F. N. M.

550.83 : 553.982

638. Electrical Mapping of Oil Structure. J. J. Jakosky and C. H. Wilson. *Min. & Met.*, 1936, **17**, 231–237.—This paper describes the operating principles and the general results obtained with an electrical resistivity method, developed by the senior writer. The method is applicable under fairly wide geological conditions, but limited to depths of penetration not exceeding 3500–4000 ft. The method differs from prior electrical methods in maintaining accurate measurement and interpretation consistent with small changes in value introduced by the deeper sub-surface stratigraphy because of the following factors:—

(1) Minimizing the variation in apparent resistivity with time of current flow by means of a constant time of measurement.

(2) Eliminating the variation in apparent resistivity with density of current flow by increasing the total current flowing in the energizing circuit as the volume of earth increases with greater depths of penetration.

(3) Development of a graphic method of interpretation based primarily on the depth resistivity logs obtained from the surface measurements.

(4) Multi-directional measurements which allow evaluation of topographic and near surface effects.

It can be used as a supplement to other geophysical methods. When operating as a constant depth traverse system, it may be employed as a rapid reconnaissance method for indicating structural changes and for the location of faults and fault zones. Illustrated by ten figures. B. F. N. M.

550.834 : 608.3

639. Patents on Geophysics. J. E. Owen. U.S.P. 2,018,737, 29.10.35. Seismic Surveying. An object of this invention is to increase the amplitude of the record obtained from a given weight of explosive, and also to lessen the effect of local disturbances. A number of relatively small charges are successively exploded close to each other in the earth's sub-surface with independent records made of each set of waves thus produced, which records are subsequently algebraically combined. In the composite record local disturbances are largely cancelled out, since they are not periodic or uniform. The amplitude of the composite record will materially exceed that obtained from a single explosion equal in weight to the combined weight of a number of charges. Nine separate charges will give a composite record, the amplitude of which is three times that of the record obtained by a single explosion of the total weight of explosive. Experiments show that small charges are in some cases more efficient as producers of seismic waves than larger ones. Four claims.

550.834 : 608.3

L. W. Blau, M. M. Slotnick and L. Statham. U.S.P. 2,018,756, 29.10.35. Compound Seismograph. A system which remains at rest when the ground carrying the case from which the system is suspended is in motion. The principle of construction can be incorporated in any vertical or horizontal mechanical seismograph and into any other electrical seismograph operating on any physical principle whatever. The invention is described as employing a second mass suspended resiliently from a first mass, in turn resiliently suspended from a frame, but also a third mass can be resiliently suspended from the second mass and the advantage of the invention retained. Ten claims.

550.834 : 608.3

W. G. Green. U.S.P. 2,024,921, 17.12.35. Method of Determining slope of sub-surface Rock Beds. The principal object of the invention is to eliminate the confusion incident to present seismic observations by providing a method whereby the slope of sub-surface rock beds can be more positively and accurately determined. This is achieved primarily by surveying as great a continuous length of the reflecting horizon as is required for definitely indicating the contour profile of the rock bed. (Four drawings illustrating steps and results.) Eight claims.

550.834 : 608.3

E. W. Johnson. U.S.P. 2,028,286, 21.1.36. Seismic Surveying. An object of this invention is to provide a means whereby an increased amount of useful energy in the form of seismic vibrations can be made available for surveying purposes. Under present methods of operation only a very small proportion of the total energy generated by explosions traverses the desired path. This is due to the explosive charge being placed in a hard geological formation, where the maximum energy which can be transmitted is that which stresses the molecules up to the elastic limit of the substance, whilst any balance of energy over this stress is wasted in shattering the material and, in addition, is lost up the bore-hole. The object of the invention is to remedy this defect and to increase the energy transmitted through the material by the explosion. The invention claims to effect this by making cavities at the bottom of a small-diameter drill-hole, which cavities should be spherical and of a diameter at least three times that of the drill-hole, and by suitably tamping the explosive. The diameter of the spherical cavity can be from 1–3 ft. Twenty claims.

550.831 : 608.3

N.V. Bat. Petr. Mij. Fr. P. 778,421, 15.3.35. Torsion Balance. The object of this invention is a bar with a brief oscillatory period and a short horizontal distance between the masses, which allows, nevertheless, an accurate record of the deviation, this end being attained by the application of measures to eliminate from the record the action of secondary oscillatory movements caused by the micro-seismic earth vibrations, which is done by lodging a bar in a cylinder, the bar having room for a little play in the cylinder. The bar has a plate diametrically orientated, fixed to shift with a slight play in the appropriate form space fixed in the case. The deviation record of the bar is effected by means of a luminous ray which is reflected by a solid mirror, which strikes a thermo-electric mechanism in which is engendered an electric current, thus allowing an electric-recording contrivance to indicate the least deviation of the bar. The bar and the torsion wire are completely immersed in a liquid. The torsion wire is fixed to the top and bottom part of the pendulum. The top mass is connected to the bar by means of an elastic gear allowing that mass to shift in a plane perpendicular to that which passes through the two masses.

550.837 : 608.3

Soc. de Prospection Electrique (Procedes Schlumberger). Fr. P. 783,824, 18.7.35. Process and Device for determining the highest level of the cementation of Casing in a Well. The process consists essentially of effecting during or immediately after cementation measurements of temperature at various depths in the well to reveal the sudden variation in temperature which occurs at the highest level of the

cementation, and also to determine the depth of it. A continuous diagram of the temperatures existing at various depths is established, showing on a curve the sudden variation of temperature at the top level of the cementation. This process also reveals cementation irregularities, such as over-thickness of the cement or bad cementation, in the first case a much higher and in the second case a much lower temperature than in neighbouring zones being betrayed. An electrical resistance thermometer is lowered progressively in the water filling the hole, the resistance measurements being recorded every instant at the ground surface. This resistance is automatically recorded by an appropriate device.

550.837 : 608.3

Soc. de Prospection Electrique (Procedes Schlumberger). Fr. P. 786,863, 11.9.35. Process and Device for the examination of the Strata traversed by a Well. This process is applicable to that part of the well which is not yet cased, and is effected by lowering into the well a sound transmitter and two sound receivers, each situated at a short distance from one another, then measuring the difference of phase of the sound vibration coming from the transmitter and transmitted through the formation to the two sound receivers. The transmitter may produce a sinusoidal vibration or a kind of dephasing occurring at the ground surface, or by the method called "bi-auriculaire," but, if the vibration is sinusoidal, by the ordinary electric phasimeter. The sound emitter and the two microphones are connected to the surface by an electric cable with several conductors to electrical amplifiers, or to the hearing apparatus "bi-auriculaire," or to the electric phasimeter. The sound-emitter device is operated by power placed in the well, and not on the surface. B. F. N. M.

Drilling.

622.24.051.4

640. Welding Hard-Facings on Drilling Tools. J. Cuthill. *J.I.P.T.*, 1936, **22**, 205–210.—A paper, presented for discussion, on some problems in welding, with reference to the application of hard-facing materials, together with a brief description of modern methods of applying hard facing in oil-field practice. G. R. N.

622.241 : 77

641. Sub-surface Photography. D. S. Sneiger. *Oil Weekly*, 6.4.36, **81** (4), 42.—Recent developments in photography have enabled sub-surface data to be more accurately studied. In the sphere of straight-hole drilling photography is playing an important part in accurate and valuable surveying of bore-holes. L. V. W. C.

622.241.2

642. Mechanical Analysis of Sizes for Prime Movers. G. P. Livermore. *Oil Weekly*, 13.4.36, **81** (5), 30.—The author makes a mechanical comparison with respect to power size of the prime movers of various types. From the analysis it can be seen that a mechanical rig is 15% more efficient between pumps and prime mover than is the D.C. electric. This means that in the case of the mechanical rig internal-combustion engines of 15% smaller capacity would be required to do the same amount of work as a D.C. electric rig.

From the standpoint of flexibility the D.C. electric rig excels all types of power rigs. L. V. W. C.

622.241.2 : 621.313.2

643. Quintuplet Rig. W. C. Lane and B. Mills. *Oil Weekly*, 6.4.36, **81** (4), 35.—A new type hook-up for gas-engine-driven direct-current generating units has been developed and put into operation in the New Mexico area. The power plant includes five small generating units, each consisting of a gas engine and generator that may be used alone or in any other combination with the remaining four units. The units are controlled by manually operated switchboard so arranged that the generators may

be connected in two series groups. The draw-works are driven by power from one group and the pump from the other.

A description of the plant is given. L. V. W. C.

622.245.33

644. Circulating Mud System. M. T. Halbouty. *Oil Weekly*, 30.3.36, **81** (3), 36.—An equalized mud is absolutely essential to proper control, and in order to obtain such, a mud shaker and agitation must be resorted to. The mud must not be allowed to flow in a steady manner as under such conditions the chemical constituents of the mud are given the opportunity to gel or become "Weight heavy." A good equalized mud can be obtained by agitation, and many probable shut downs have been eliminated by this means.

A diagram of a simple but efficient design for a circulating system is given together with an explanation of its operation. L. V. W. C.

622.245.33

645. Economic Use of Mud Materials in Rotary Fluid Control. M. T. Halbouty. *Oil Weekly*, 6.4.36, **81** (4), 30.—An examination of the various types of muds necessary for efficient drilling is made, and charts are given showing the types of common drilling muds with their percentage solids–viscosity characteristics and the variation of colloidal content between 3% gel type and 90% type colloidal matter.

L. V. W. C.

622.245.42

646. Hardening of Cement under Temperature and Pressure. S. L. Meyers. *Petr. Eng.*, March 1936, 7 (6), 30.—A series of tests are described showing the effect of temperature and pressure on cement up to the age of three months. Curves and tables are given. L. V. W. C.

622.248.34

647. Drilling Heaving Shale. K. C. Sclater. *Petr. Eng.*, March 1936, 7 (6), 27.—An investigation of the heaving-shale problem discloses the fact that innumerable varieties of shales are encountered that cause trouble in drilling. Most of these have a tremendous affinity for water, and when they take up water they swell and disintegrate. The shales which hydrate in this manner are bentonitic in character, and it is this character that accounts for their tendency to heave.

A successful solution of the problem lay in finding some means of protecting the shale from being wetted by water. To prevent this wetting a mud has been developed the chief ingredient of which is sodium silicate. A strong alkaline brand of sodium silicate solution is used, and the colloids stay in suspension and the shale is covered by a gelatinous film that excludes the water.

Elimination of pulling the drill-pipe has assisted, and this has been made possible by the use of a wire-line collapsible bit. L. V. W. C.

628.54 : 614.777

648. Study of Salt-water Problems. F. Swindell. *Oil Weekly*, 20.4.36, **81** (5), 66.—A million barrels of salt water per day have to be disposed of in Kansas and Oklahoma. Each barrel of salt water brought to the surface increases lifting costs due to larger volume of fluid to be handled.

A study of the problem of water disposal shows that the cost of the disposal exceeds the amount that accrues annually in damages. A further study revealed the fact that a determination could be made as to whether this water might be in condition to return to the formation as a flooding agent, or that, if not in condition in its natural state, what treatment would be necessary to properly prepare it.

A definite programme has been adopted as the result of the studies carried out. A pollution project map is first prepared. The log of each well is studied to determine possibilities of plugging off bottom tide water. The general structural conditions, property and royalty ownership are studied. L. V. W. C.

622.24.053 : 608.3

640. Patents on Drilling Plant. C. J. Wilkinson. U.S.P. 2,033,409, 10.3.36. A rotary pipe-tool joint consisting of a tapered pin supplied with a number of radial keys which fit into slots on the collar and a locking device.

622.245.13 : 608.3

W. Horn. U.S.P. 2,033,521, 10.3.36. A device for supporting a well liner in its correct position in the well.

622.245.44 : 608.3

W. T. Wells. U.S.P. 2,033,560 and 2,033,561, 10.3.36. A well packer operated by a refrigerating unit, extracting heat from the selected portion of the bore.

622.245.2 : 608.3

W. T. Wells. U.S.P. 2,033,562, 10.3.36. A method of sectionally cleaning wells of drilling mud by perforating the casing in situ in two zones and washing the space between the two perforations.

622.279 : 608.3

W. T. Wells. U.S.P. 2,033,563, 10.3.36. A flow-regulating device for oil wells.

622.245.44 : 608.3

W. T. Wells. U.S.P. 2,033,564, 10.3.36. A bypass packer for oil wells.

622.24.053 : 608.3

W. L. Skin. U.S.P. 2,033,592, 10.3.36. A rubber drill-pipe protector.

622.24.051.42 : 608.3

J. C. Wright. U.S.P. 2,034,072, 17.3.36. A core bit and breaker. The breaker imposes a lateral strain on the core to break it at its lower portion.

622.24.051.4 : 608.3

J. C. Wright. U.S.P. 2,034,073 and 2,024,074, 17.3.36. A well bit having two cutting faces, one in the main body of the tool and the other in a tube extending below the main body.

622.24.051.4 : 608.3

J. C. Wright. U.S.P. 2,034,075, 17.3.36. A convertible drilling bit.

622.245.14 : 608.3

F. E. O'Neill. U.S.P. 2,034,768, 24.3.36. A means of perforating casing using the pressure of the column of fluid in the hole.

622.276.4 : 608.3

W. L. Clark. U.S.P. 2,034,798, 24.3.36. A method of flowing by means of a pressure medium in one well, delivering this medium to another well for effecting flow.

622.24.051 : 608.3

H. E. Philip. U.S.P. 2,034,957, 24.3.36. A formation testing tool for oil wells.

622.24.051.4 : 608.3

F. R. Stoll. U.S.P. 2,035,350, 24.3.36. A well-drilling apparatus comprising two concentric shells suspended at the surface with a bit attached to the inner shell extending below the outer and means for reciprocating the inner shell.

622.276.4 : 608.3

R. P. Abele. U.S.P. 2,025,381 and 2,035,382, 24.3.36. A means for increasing the productivity of an oil well by the use of a pump and circulation of heated fluid.

622.276.4 : 608.3

J. R. Vandover. U.S.P. 2,035,412 and 2,035,413. A heater for lowering into oil wells.

622.245.1 : 608.3

C. S. Crick. U.S.P. 2,035,637, 31.3.36. A friction shoe.

622.245.53 : 608.3

M. B. Pitzer. U.S.P. 2,035,719, 31.3.36. A means of forming a cavity at the bottom of the well and applying a treated material to form a porous formation.

622.24.051.5 : 608.3

C. L. Walker. U.S.P. 2,035,852, 31.3.36. A well-drilling device consisting of collapsible rotary tools capable of passing through the drill stem.

L. V. W. C.

Production.

622.245.14

650. Casing Perforation by Gunfire and its Application to Oil Production. E. R. Smith. *Min. & Met.*, 1936, **17**, 243.—This new and important development is described and illustrated by three photographs and a drawing. The practical values of the method are given as follows: Improved control of gas and oil ratios. Improved plugging back of wells to shut off bottom waters. Increased oil recovery by withdrawing the oil from relatively thin sand units, commencing at the bottom and proceeding upwards as the units are exhausted. Opening of upper producing sands that have been cased off. Simultaneous production from multiple oil-bearing sands with intervening water-bearing strata. Decreased casing costs, etc.

The gun Perforator is a novel device the value of which is only to be learned by experience.

B. F. N. M.

622.276.95

651. Excessive High Starting Pressure may Damage Wells on Gas-Lift. T. F. Smiley. *Oil & Gas J.*, 30.4.36, **34** (50), 46.—Starting pressure of a gas-lift well which exceeds the rock pressure is exceedingly dangerous to certain types of wells, such as mudded or paraffined wells, where the direction of pressure differential is reversed by high starting pressure, even for a short time, as the walls of a hole are liable to become plastered and the drainage area partly closed. W. H. Osgood, in "Increasing the Recovery of Petroleum," records experiences on this subject to the effect that starting pressures are usually from two to five times higher than normal operating pressures due to the greater density of the unaerated fluid in the well. General statements of a range of figures of the starting pressures in one field or group of wells are only of value for that field. Pressures higher than the existing rock pressures are liable to do irreparable harm to a well. It is believed that as soon as the applied pressure plus the weight of the column of oil in the well exceeds the formation pressure, some of the oil will flow back into the sand. Some installations postulate that sudden pressure application of brief duration will not cause the oil to return to the sand to any extent, but when the incompressibility of the oil column, no gas present, is considered, it seems that with any mud, wax or foreign matter in the well bottom, it will be forced into the hole's surface sand pores, and when normal flow is re-established, the wells do not return to their pre-pressure condition, and must be cleaned.

B. F. N. M.

622.276.95

652. Producing Wells to Exhaustion by Gas Lift. S. F. Shaw. *Oil Weekly*, 6.4.36, **81** (4), 17.—The use of natural gas through small size tubing is enabling many of the wells in the Oklahoma City field to show some remarkable lifting records. Compressed gas at 300 lb. pressure is being used. When continuous gas lift involved the use of too much gas, the same tubing strings were reamed, and plunger lifts were

installed. With the exception of one well, all the wells have continued on this method to the present time. Production has been maintained as high as or higher than in the offset wells, and operating expenses and down time are very low.

L. V. W. C.

622.276.05

653. Gas-Lift Operations. S. F. Shaw. *Oil Weekly*, 20.4.35, **81** (5), 35.—The handling of gas-lift methods is essentially an engineering matter, and must be treated as such if any satisfactory degree of success is to be attained.

The first set of control data in connection with a producing well that should be determined is that of the maximum quantity of oil that can be lifted under the most favourable conditions, corresponding to a given pressure at the bottom of the well.

After the production–pressure relationship has been established for various sizes of casing, it is desirable to determine the relation between production of oil and the quantity of gas required to lift the oil at maximum rate at a given bottom-hole flowing pressure.

Progress charts of each well should be prepared. Various curves for cubic feet of output gas required to lift at maximum rates, etc., are given. L. V. W. C.

622.323 : 658.787.6 : 665.512

654. Metering Gas and Oil. H. V. Beck. *Oil Weekly*, 30.3.36, **81** (3), 22.—The significance of Reynolds Number in the measurement of fluid flow in relation to orifice meter coefficients is considered. From results obtained with various dissimilar fluids over a wide range of viscosity, consistent data have been obtained which, when plotted, form a single smooth curve. L. V. W. C.

622.323 : 66.066.3

655. Water Knockout. J. C. Albright. *Oil Weekly*, 20.4.36, **81** (5), 72.—Free water is being produced with the oil in a number of wells in the Fitts field, Oklahoma, and a simple method of separating the fluid from the crude between the christmas tree and the oil and gas separator has been developed. A knockout unit of simple construction has been designed.

This unit is automatic in operation, and requires very little attention. Several joints of different size pipe are used in the construction of each unit, and the joint through which the fluid flows first is equipped with a float unit similar to the types used in oil and gas separators. The first chamber is equipped with an overhead three-inch line through which the oil and gas pass to the second chamber, and thence to the mid-section and leave at the top.

From the tubing-head christmas tree the water enters the first section of the knockout above the float mechanism. The free water immediately settles to the base of the chambers, where it is maintained at a constant level. L. V. W. C.

Pipe-Lines.

532.511

656. Nomographic Charts for Measuring Flow of Viscous Fluids. Parts I and II. H. V. Beck. *Refiner*, 1936, **15**, 77, 120.—Five charts are given: (1) for determining the Reynolds Number, (2) for the measurement of fluid flow with orifices, nozzles or venturi tubes, (3) for determining the coefficients used in (2), (4) for determining the Reynolds Number for a fluid flowing in a pipe-line, and (5) for determining friction loss for fluid flow in pipe-lines. G. R. N.

622.698

657. Use of Welding in Transportation and Storage of Oil. A. C. Hartley and A. C. Vivian. *J.I.P.T.*, 1936, **22**, 224–232.—A paper, presented for discussion, dealing with early uses of oxy-acetylene welding, electric arc welding, method of jointing, repair work, plain butt welds, reduced thickness of pipe, reliability with speed, testing of personnel, layout of welded lines, pipe manufacture, grade of steel, storage tanks, and electric welding equipment. G. R. N.

Corrosion.

620.197 : 621.357.6

658. Corrosion-Protective Value of Electrodeposited Zinc and Cadmium Coatings on Steel. W. Blum, P. W. C. Strausser and A. Brenner. *Bur. Stand. J. Research*, 1936, **16**, 185–212.—The paper describes and discusses the results obtained on the atmospheric exposure for about 3½ years of zinc, cadmium and zinc–cadmium coatings on steel.

Standard procedures were adopted for plating to enable comparisons to be drawn.

The specimens were exposed in six locations, inclined 30° from the horizontal facing south and inspected periodically. Since these coatings are generally used outdoors only when appearance is a secondary factor, little attention was paid to loss of lustre, presence of stains or white coatings, but simply to areas of rusting.

The reproducibility of the tests was found to be quite good. In rural or purely marine climates these coatings were found to give better protection than either Ni or Cr. In industrial areas, with sulphurous and sulphuric acid present, both Zn and Cd platings were attacked rapidly, their life being proportional to the thickness of the coatings. Cadmium failed in about ⅔ time required for Zn of the same thickness, whilst an alloy containing about 10% Cd was superior to either metal.

Variations in the conditions of plating had no marked effects, and hot dipped zinc coatings gave about the same protection as plated coatings of the same thickness.

Accelerated tests have been carried out using sodium chloride as the principal corroding agent and employed two methods : (*a*) salt spray, (*b*) intermittent immersion in salt solution. In these tests the times required for the failure of zinc coatings were proportional to their thickness, but cadmium lasted longer than zinc in the salt spray, which is the reverse of what occurs on exposure to industrial conditions.

The protective value of these coatings depends on the minimum thickness, which can be determined by (*a*) dropping tests using a solution of iodine in KI solution, or acidified ammonium nitrate, (*b*) microscopic measurement or (*c*) the chord method.

D. L. S.

620.197 : 667.624

659. Paint in the Petroleum Industry. H. B. Footner. *Petr. Times*, 1936, **35**, 399–408.—The article comprises a comprehensive survey of the application of paint as means of combating corrosion in the aspects peculiar to the petroleum industry. Great emphasis is laid on the necessity of thoroughly cleaning and drying metal surfaces prior to painting. It has been demonstrated that "millscale," the blue, smooth film of oxide present on, for instance, freshly rolled tank plates, is responsible for the failure of many paint films. Owing to its smoothness, adhesion of the paint film in the first place is poor, a condition promoting early flaking of the film. Millscale is best removed by one of the recently developed acid-pickling processes. This treatment should be followed by the application of at least a priming coat within 24 hours. Other and less satisfactory methods of cleaning metal surfaces are cited. For priming coats a linseed oil/pure red lead paint is recommended. Brushing by skilled labour is stated to be superior to spraying as the method of application. The function of a finishing coat is to protect the priming coat, which is the true anti-corrosion medium. Heat-reflecting properties are at least as important as weather resistance, and in this respect white paint shows a small advantage over aluminium paints, but only as long as the former remains white. Titanium oxide paints are very satisfactory for this purpose, since they tend to "chalk" on exposure, and so always to present a clean surface. In climates where the rainfall is excessive, however, this process shortens the life of the paint below the economic limit. Aluminium paint may give a life of six years, provided the initial cleaning and priming of the tank have been efficient. The use of aluminium paint without a primer is not satisfactory. The normal covering capacity is 800 sq. ft. per gallon. Linseed-oil vehicles are better than the quick-drying varnish type, as the latter tend to crack rapidly. Where dark-coloured finishing paint is required the black iron oxide type is very suitable. The protection of the insides of tanks presents a difficult problem, and no entirely satisfactory paint has been produced. A cement/glue wash is probably the most satisfactory treatment. For buried tanks efficient cleansing of the surface is essential, and bituminous enamels are recommended. For road and rail tanks red-lead primer is again recommended, followed by nitro-

cellulose filler, undercoating and finishing lacquer. Such surfaces are more durable than those produced by the old coach-painting system. Ships present special problems. Quick-drying paints are needed, since there is seldom time to allow the more usual types of red-lead paints to dry. Corrosion is most severe between the light and loaded lines, and on this area a good-quality "boot-topping" paint should be applied. There are a number of such proprietary paints available. Oil paints are satisfactory for the hull above the water-line, but the bituminous "top-sides" paints have the advantage of quicker-drying properties. H. G.

621.315.615.2

660. Corrosion of Metals by Technical Insulating Oils. P. J. Haringhuizen and D. A. Was. Tech. Publ. Intern. Res. Dev. Council, Series A, No. 35, 1936; *Proc. K. Akad. Wetensch. Amsterdam*, 1936, **39**, 201–214.—The corrosion of tin, copper, and lead has been investigated by an optical method, based on the increase of light transmission of their metal layers due to the corrosion. It is concluded that the metals build up a protective film of reaction products on their surfaces. In copper this film is destroyed, but tin and lead have a durable resistant film. Experiments showed that the velocity of corrosion is not related to the concentration of acids formed by deterioration of the oils. The results are expressed by an experimental formula. G. S.

667.624.17

661. Protective Coatings for Steel Tubes. H. Klas and H. Steinrath. *Bitumen*, 1936, **6**, 18–20, 40–42.—Various processes which have been proposed for protecting steel pipes against corrosion when laid underground are briefly summarized. Bituminous paints possess certain advantages. Coal-tar must be distilled and blended with pitch or hard bitumen and anthracene oil or other softening agents in order to obtain a satisfactory product. Bitumen may be superior to tar, forming a coating resistant to mechanical shock and unattacked by water or earth, while it also protects the pipe against stray electric currents which tend to initiate corrosion. A number of methods of application of the bitumen are described. The latter may be applied hot or in solution, while for additional protection a layer of impregnated jute or felt may be applied. The "Sling" method, which was largely used for the Irak pipe-line for coating pipes with hot bitumen, is also described. Water-carrying pipes are frequently coated inside, the hot bitumen being evenly spread out by a centrifugal process. C. C.

667.624.17

662. Corrosion from Water. Choice and Modes of Application of Bituminous Paints. H. Walther. *Paint Manufacture*, 1936, **6**, 77.—This is the report of a paper given at a recent conference in Berlin on "Corrosion from Water."

Among the numerous grades of bitumen and pitch recommended for anti-corrosive purposes, Mexican bitumen and bituminous coal pitch are most extensively used. Bitumens can be divided into the blown and high-vacuum types.

As a rule, the melting point is given to indicate physical properties. This, however, is scarcely adequate, and the so-called breaking point offers a further criterion. A wide gap between melting point and breaking point is typical of blown bitumens, and these should be used when the paint is required to be resistant to bending or shock and abrupt alternations of heat and cold. The main advantage of high-vacuum bitumen is superior fastness to light.

Coal-tar pitches are more sensitive to temperature changes, shock and impact, and the gap between melting point and breaking point is smaller. Blown Mexican bitumen gives a gap of about 77° C. and pure tar pitch 45° C.

Both bitumen and pitch are very resistant to water penetration. The adhesive power when applied to iron is greater for pitch than for blown bitumen, and this is linked up with the superior wetting power of the coal product.

As regards weathering resistance, blown bitumens are the least satisfactory, the high vacuum product, and pitch in particular, being appreciably more resistant. Acid degradation products are formed on exposure to light and moisture—only a small amount with pitch, 3–4 times as much by high vacuum bitumen, and 8–10 times that quantity by the blown product.

The application of the materials may be made as solutions, aqueous emulsions or hot dippings, a primer being necessary in the last case. Oil paints used with priming coats have given the most striking results. D. L. S.

Gas.

661.715.214.2 : 608.3

663. Patents on Gas. H. Dreyfus. E.P. 440,432, 30.12.35. Preparation of acetylene from paraffinic hydrocarbons by heating in the form of a very thin annular sheet ($< 1''$ diam.) to 1200–1600° C., or to 1000–1200 when olefinic hydrocarbons are used, heat being applied to both sides of the sheet.

66.097 : 608.3

Metallges. A.G. E.P. 443,792, 5.3.36. A process and apparatus is described for carrying out reactions in the gaseous phase in the presence of catalysts, *e.g.* production of H_2SO_4 by contact catalysis employing the introduction of different gas currents simultaneously. The amount of at least one of the gases introduced per unit time is continuously or periodically controlled by the aid of gas-metering instruments, according to the active constituents present in the reaction gas.

665.542.2 : 608.3

Chem. Construction Corpn. and F. J. Bartholomew. E.P. 443,800, 6.3.36. Sulphur dioxide from the thermal decomposition of acid sludge obtained in refining hydrocarbons is removed from the liquor by means of an air stream to form a gas having sufficient concentration for use in the sulphuric acid contact process.

665.541 : 608.3

A. Carpmael. E.P. 443,848, 9.3.36. Apparatus for the treatment of solids with liquids if desired in the presence of gases, *e.g.* counter-current washing of materials or simultaneous treatment of compounds with an oxidizing solution and oxidizing gases. A conveying worm, tube or drum is rotated in a casing, openings being provided in the sheet of the worm or between the worm and casing, and with the rigid shovels between the threads of the worm.

66.094.1 : 608.3

J. Y. Johnson. E.P. 444,327, 19.3.36. Recovery of hydrogen sulphide from gases from the destructive hydrogenation of coal and containing carbon dioxide. The gases are treated with an alkaline absorption liquid in an atomized form keeping the time of contact of the liquid with the gas below 5 secs., and recovering the hydrogen sulphide by heating the resultant liquor.

665.521.1 : 608.3

Sturtevant Eng. Co., Ltd., and H. W. Wagner. E.P. 444,333, 19.3.36. Apparatus for electrostatic precipitation of suspended matter from gas.

665.521.1 : 608.3

Sturtevant Eng. Co., Ltd. E.P. 444,426, 20.3.36. Improved rapping mechanism for use in the electrostatic precipitation of dust from gas.

665.521.1 : 608.3

B.T.H. Co., Ltd. E.P. 444,526, 23.3.36. Method of carrying out chemical reactions by means of silent electric discharges by bringing the current of gas into oscillation by acoustic incitation and then exposing to the electric discharge.

66.097 : 608.3

J. Y. Johnson. E.P. 444,698, 30.3.36. Improvement in apparatus for carrying out exothermic catalytic gas reactions in which tubular reaction chambers are used. The layer of catalyst is subdivided and the gases are cooled within the tubes before

those parts at which overheating would otherwise occur, by flashing the exterior of the tubes with an additional current of cool fresh gas, preferably at points where the tubes are free from catalyst.

66.097 : 668.3

Non-Poisonous Gas Holding Co., Ltd. E.P. 445,012, 1.4.36. Improvements in gas reactions carried out with the aid of contact substances. The latter are used in round form, and are removed from one end of the contact chamber as they become inactive without interfering with the reaction. The withdrawn substances are reactivated and introduced at the opposite end. W. S. E. C.

Crude Oil.

665.51 : 66.093.64 : 668.3

664. Patents on Crude Oil. M. De Groote, B. Keiser and A. F. Wirtel. U.S.P. 2,037,885–2,037,886, 21.4.36. Breaking of petroleum emulsions by the action of a demulsifying agent, consisting of a poly-keto fatty acid in the form of an ester derived from castor oil, *e.g.* salt of ketohydroxystearic acid. W. S. E. C.

Physical Chemistry.

542.74

665. Rates of Solution of Gases in Oils. E. A. Bertram and W. N. Lacey. *Ind. Eng. Chem.*, 1936, **28**, 316.—A study of the rate of solution of methane in hydrocarbon oils filling the interstices between closely packed silica sands shows that the process is substantially the same as for the case of quiescent oils in the absence of sand.

In the case of the sands studied, which were unconsolidated, the date of solution may be calculated from the overall area at right angles to the path of diffusion, multiplied by the fraction of the total volume occupied by oil and by a factor 0·82. This factor has been found to be constant throughout the conditions of the experiments, and a similar value has been obtained from electrical conductivity measurements.

P. D.

542.74

666. Absorption of Air by Mineral Oils. A. Gemant. *Trans. Faraday Soc.*, 1936, **32**, 694.—An apparatus and method are described, based on manometric principle, for measuring the absorption of gases by liquids and its temperature coefficient. The apparatus and method were first tested by carrying out some test measurements with water, the absorption coefficients of which were already known. The apparatus is then utilized to measure the absorption of air in mineral oils for 20° and 80° C. The Bunsen absorption coefficient (Volume of gas reduced to normal pressure and 0° C., absorbed by 1 c.c. of oil at a partial pressure of the gas of 760 mm. mercury) is given by

$$\alpha = \frac{T_0}{T} \cdot \frac{V}{vM}$$

where T = absolute temperature of air, $T_0 = 273{\cdot}1$ and v = specific volume of oil. From the experimental results obtained from various oils, it appears that the Bunsen coefficient α is practically constant within the range of temperature 20–80° C., the variation in general being $< 1\%$.

By applying the second law of thermodynamics to the absorption process, the equation

$$\frac{d \ln \lambda}{dT} = -\frac{Q}{RT^2} \quad \ldots\ldots\ldots\ldots \quad (1)$$

is obtained, in which λ is the Ostwald absorption coefficient, related to α by

$$\alpha = \frac{T_0}{T}\lambda$$

and Q is the molar latent heat of absorption. From equation (1) it is possible to compute the temperature coefficient of α in terms of the latent heat. On the

assumption that the absorption is a purely physical process, no interchange occurring between the molecules of solvent and gas, the following equation is derived

$$\frac{d \ln \lambda}{dT} = -\frac{\ln \lambda}{T} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Equation (2) is not fulfilled at all in the case of oil and air, although it is approximately fulfilled in the case of hydrogen and oil. Hence from thermodynamical considerations the conclusion is reached, that oxygen undergoes a secondary reversible chemical reaction immediately after absorption, and that the latent heat of this reaction is of the order $RT \ln \lambda$, a conclusion supported by unpublished work of the author on the oxidation of mineral oils.

Finally, some conclusions are reached as to the temperature variation of the electrical breakdown strength of mineral oil. H. E. T.

547.21 : 536.63

667. Phase Equilibria in Hydrocarbon Systems. XII. Specific Heats of some Mixtures of Propane, *n*-Butane and *n*-Pentane. B. H. Sage, H. S. Backus and T. Vermeulen. *Ind. Eng. Chem.*, 1936, **28**, 489.—Pressure–volume–temperature data were obtained for a mixture of propane (79·41 vol. %) and pentane (20·59 vol. %) in order to investigate the deviation from the law of ideal solutions. The deviation was found to be small except at higher temperatures approaching the critical temperature of propane. The data are given in the form of tables and a temperature–entropy diagram for the particular mixture. The results showed sufficiently small deviation from the law of ideal solutions to allow corrections to be applied to experimental results on the specific heats of two-component mixtures of propane, *n*-butane and *n*-pentane to give the specific heat of the liquid at constant pressure adjacent to the bubble point. P. D.

547.217.2

668. Preparation of *Iso*-Octane. G. S. Parks and S. S. Todd. *Ind. Eng. Chem.*, 1936, **28**, 418.—The work here recorded illustrates the use of recent thermodynamical data in the consideration of two processes for the conversion of *iso*butene into *iso*-octane (2 : 2 : 4-trimethylpentane). The first method considered involves two steps : (*a*) the polymerization of *iso*butene to *di-iso*butylene and (*b*) the hydrogenation of *di-iso*-butylene to produce *iso*-octane. The second method for the production of *iso*-octane investigated thermodynamically involves the direct reaction of *iso*butane with *iso*butene to produce the desired compound. With new data available for paraffin and olefinic hydrocarbons, the free energy relations for these two methods of producing *iso*-octane from *iso*butene are considered with special reference to temperature limitations. H. E. T.

547.25.815 : 535.34

669. Photolysis of Lead Tetramethyl and Lead Tetraphenyl. P. A. Leighton and R. A. Mortensen. *J.A.C.S.*, 1936, **58**, 448–454.—The absorption spectra of the above two substances, as well as for lead tetra-ethyl, have been determined and the approximate long wave-length absorption limits have been observed, both for the vapour state and with the compound in trimethylpentane solution. Lead tetramethyl and lead tetra-ethyl, in *iso*-octane solution and in the pure liquid, were decomposed by the absorption of radiation in the ultra-violet. A black deposit of metallic lead was formed. In the gaseous phase, lead tetramethyl gave chiefly ethane. In general the reaction is

$$PbR_4 \longrightarrow Pb + 2R_2$$

The authors have determined the quantum yields for lead tetramethyl vapour and for solution in *iso*-octane, in the wave-length region centred around 2537 Å.
W. E. J. B.

547.313.2 : 66.093.4

670. Free Energy of Ethylene Hydration. E. R. Gilliland, R. C. Gunness and V. O. Bowles. *Ind. Eng. Chem.*, 1936, **28**, 370.—The free energy change for the hydration of ethylene

$$C_2H_4(g) + H_2O(g) \rightarrow C_2H_5OH(g)$$

has been found by the authors to be represented by the equation

$$\Delta F^\circ = 26{\cdot}97T - 8300$$

within an accuracy of ± 500 calories. This equation for the free energy is based on all available data, and is applicable over a temperature range of from 150° C. to 380° C.
H. E. T.

547.41

671. Condensation of Aliphatic Alcohols with Aromatic Compounds in the Presence of Aluminium Chloride. R. C. Huston and T. Y. Hsieh. *J.A.C.S.*, 1936, **58**, 439–441.—Aliphatic secondary and tertiary alcohols condense with benzene to give the corresponding alkylbenzenes. The tertiary alcohols react more readily and give better yields than the secondary alcohols, whilst under the conditions used, aliphatic primary alcohols do not condense with either phenol or benzene. Hydrocarbons prepared in this way included cumene, methylethylphenylmethane, trimethylphenylmethane, etc.
W. E. J. B.

547.534

672. Vapour Pressure of Xylenes and Mesitylene. L. S. Kassel. *J.A.C.S.*, 1936, **58**, 670–671.—The author has measured the vapour pressure of *ortho*-, *meta*- and *para*-xylene and mesitylene from approx. 100° C. to 0° C. The results are expressed in the form of equations of the type

$$\log_{10} P = -\frac{A}{T} - 5 \log_{10} T + B,$$

where T is in degrees absolute, A and B are constants and P = mm. of mercury. The values of A and B for the *ortho*-, *meta*-, *para*-xylenes and mesitylene are, respectively, 2830·0 and 22·7480, 2876·3 and 22·9425, 2930·0 and 23·1000, 3104·5 and 23·1929. The calculated entropies of vaporization to the hypothetical perfect gas at 25° C. and atmospheric pressure were respectively, in entropy units, 24·35, 25·24, 25·96 and 26·39.
W. E. J. B.

661.715.2 : 535.34

673. Stability of Pure Hydrocarbons to Light. J. C. Morrell, W. L. Benedict and G. Egloff. *Ind. Eng. Chem.*, 1936, **28**, 448.—The effect of small additions of elementary sulphur and *n*-propyl disulphide on the stability of pure hydrocarbons is described for a variety of pure hydrocarbons representative of those present in straight-run and cracked gasoline. The hydrocarbon, and hydrocarbon solutions of sulphur and *n*-propyl disulphide were tested by exposure to the arc lamp for one hour in atmospheres of oxygen, hydrogen or nitrogen. The results show that, with the exception of benzene, which develops colour on exposure to light in oxygen, nitrogen and hydrogen, the pure hydrocarbons do not develop colour or haze, although peroxide, acid and aldehyde are formed on exposure to light and oxygen, especially in the olefine, *cyclo*-olefine, diolefine and turpene hydrocarbons.

In the presence of elementary sulphur all the hydrocarbons develop colour on exposure to light, and in an oxygen atmosphere all hydrocarbons except 2-octene, *cyclo*pentadiene and *d*-limonene develop haze. All the hydrocarbons react with elementary sulphur in the presence of light, the olefine and *cyclo*-olefine giving rise to hydrogen sulphide and mercaptans; the paraffins, *cyclo*paraffins and aromatic hydrocarbons to hydrogen sulphide and hydrocarbon sulphides.

n-Propyldisulphide caused the development of colour or haze, depending on conditions, but in all cases the hydrocarbons to which the disulphide was added contained sulphur dioxide and trioxide after exposure to light and oxygen, while in atmospheres or nitrogen or hydrogen mercaptan formation was observed.
F. E. A. T.

Chemistry of Petroleum.

547.21

674. Action of Aluminium Chloride on Paraffins. V. N. Ipatieff and A. V. Grosse. *Ind. Eng. Chem.*, 1936, **28**, 461.—The action of aluminium chloride on *n*-butane, *n*-hexane, *n*-heptane, and 2 : 2 : 4-trimethylpentane has been studied. It is shown

that the presence of hydrogen chloride is essential to the reaction, and that if hydrogen chloride and water are excluded, no reaction takes place unless the temperature is raised considerably.

The reaction products consist in all four cases of a water-white upper layer of mixed paraffins of lower and higher molecular weight, with a small layer containing the aluminium chloride in combination with highly unsaturated hydrocarbons.

The reactivity of the paraffins is shown to increase under comparable conditions, both with molecular weight and degree of branching, and the reaction is accounted for by assuming that the aluminium chloride plus hydrogen chloride splits a carbon bond in the original paraffin hydrocarbon molecule, producing a paraffin of lower molecular weight, and an olefine which immediately combines with another paraffin molecule. The different single steps taking place are discussed, and the whole combined under a general equation for "autodestructive alkylation." F. E. A. T.

547.216

675. **Preparation of the Isomeric Hexanes.** P. L. Cramer and M. J. Mulligan. *J.A.C.S.*, 1936, **58**, 373–374.—The authors have prepared n-hexane, 2-methylpentane, 3-methylpentane, 2 : 3-dimethylbutane and 2 : 2-dimethylbutane. The general scheme of preparation was alcohol–olefin–paraffin, the alcohol being dehydrated using Al_2O_3, I_2 or HBr as catalyst and the hydrogenation of the olefin was effected using platinum oxide catalyst. A table of constants is given which includes b. p., d_4^{20} and n_D^{20}. W. E. J. B.

547.2173.

676. **Methyl Nonanes.** G. Calingaert and H. Soroos. *J.A.C.S.*, 1936, **58**, 635–636.—The four isomeric methylnonanes have been prepared by the conventional Grignard method of synthesis using the appropriate alkyl halides and oxy-compounds. The carbinols so produced were dehydrated and hydrogenated simultaneously by treatment with hydrogen under 200 atmospheres pressure at 250° C. in the presence of 4% of Raney nickel catalyst. The purified hydrocarbons were examined for b. p., m. p., d_4^{20}, n_D^{20} and C.T.S. in aniline. The data indicate that a shift of the methyl group from the 3-position towards the centre of the molecule (*a*) progressively lowers the boiling point, but with a decreasing increment, (*b*) slightly decreases the index of refraction, (*c*) decreases the density, except that the 5-methyl isomer shows a slight increase in density. Thus it seems probable that above C_{10} the identification of branched chain alkanes will not be possible on the basis of simple physical properties. Tests such as melting point will be necessary. W. E. J. B.

547.313

677. **Thermal Rearrangements Among the Pentenes.** C. D. Hurd, G. H. Goodyear and A. R. Goldsby. *J.A.C.S.*, 1936, **58**, 235–237.—The present study was conducted at 500–600° C. and both 1-pentene and 2-pentene were examined. The entire gaseous reaction product was analysed, with particular attention to the C_4 and C_5 components. The results indicated that 1-pentene underwent pyrolytic rearrangement to a small extent into 2-pentene and *vice versa* at temperatures above 580° C. From the pure materials, either 1- or 2-pentene, no branched chain isomers were formed, but more than 90% of the gaseous products were methane, 1-butene, propylene, ethane and ethylene in the molar ratio of 6 : 2 : 2 : 2 : 1. Other products identified were 2-butene, butadiene and hydrogen, whilst in the liquid products, which were rather less than half the total products formed, aromatics and unsaturateds (presumably *cyclo*alkenes) were apparently present. W. E. J. B.

547.313

678. **High-Temperature Pyrolysis of Gaseous Olefines.** H. Tropsch, C. I. Parrish and G. Egloff. *Ind. Eng. Chem.*, 1936, **28**, 581.—The pyrolysis of the five olefines, ethylene, propene, 1-butene, 2-butene and *iso*butene, has been studied at temperatures of 1100° and 1400° C. under a pressure of 50 mm., and with a contact time of the order of 0·001 second. The relative stability of the five olefines under investigation at 1100° C. decreases in the order ethylene, propene, 2-butene, 1-butene, *iso*butene.

In the experiments at 1400° C. no propene + butene was obtained, and butadiene was obtained only from propene, the maximum yield being 4·2 wt. % and a contact time of 0·0008 second. In addition to liquid product, carbon was produced in every experiment. With the exception of propene and 1-butene at 1100° C. and ethylene at 1400° C., the volume of cracked gas reached a maximum in every pyrolysis within the range of contact times studied; further, the paraffins obtained exceeded 25% except in the cases of ethylene and propene. For larger contact times hydrogen is an important product of the reaction in all pyrolyses, the yield, in general, increasing with the contact time. Tables are given showing the maximum yields from the five olefines, in litres per 100 litres of entering olefines, of unsaturated hydrocarbons at 1100° and 1400° C. and 50 mm. with a contact time of 0·001 second. H. E. T.

547.313.3 : 66.095.26

679. Propylene Polymerization. O. L. Brandes, W. A. Gruse and A. Lowry. *Ind. Eng. Chem.*, 1936, **28**, 554.—The polymerization of propylene in a closed-pressure apparatus has been studied under various conditions of temperature, pressure and time of contact, the catalyst used being anhydrous zinc chloride. The conditions of the various experiments undertaken were varied in order to obtain those which yielded the maximum yield of liquid product of gasoline type. For each set of experimental conditions investigated a sufficient quantity of the reaction product was obtained to enable an accurate fractionation to be carried out. The main temperatures used were 290–310° C., 200–210° C. and 150–160° C., and liquid polymer yields as high as 74·2, 43·5, and 64·4% by wt. were obtained under the three respective conditions. A total of 74·5% by vol. of the 290–310° C. product, 85·9% of the 200–210° C. product, and 92% of the 150–160° C. product distilled in the gasoline range, *i.e.* up to 200° C. end-point. The data obtained by fractionation of the liquid polymers and subsequent examination of the fractions indicated the absence of aromatic hydrocarbons, but showed the presence of considerable amounts of naphthenic hydrocarbons in various fractions, in addition to olefinic and paraffinic hydrocarbons. H. E. T.

Analysis and Testing.

542.48 : 665.5

680. Experimental and Process Development Methods in Petroleum. L. C. Trescott. *Refiner*, 1936, **15**, 60, 104.—The first article is entirely devoted to the lab. distillation of crude oil in conventional stills of 5- and 15-gallon size; typical results of the assay of various crudes are given. In the second article acid treatment, neutralization, contact filtration, percolation filtration and dewaxing are discussed. With regard to acid treatment on the 10-litre scale air agitation is preferred to shaking and multi-treating to single treating; an example is given for balancing the yields of sour oil, sludge and loss. In neutralization the technique and control of the soda-wash are described, while in contact filtration the preferred method is to agitate a heated mixture of the oil and clay in a metal beaker and filter on a Buchner funnel. In the case of percolation filtration and dewaxing, the technique appears to be dependent entirely on the plant process results, so no general rules can be given. Emphasis is laid on the need for costing each stage of any process method and examples are given.
G. R. N.

667.634

681. Physical Study of Two-Coat Paint Systems. D. W. Robertson and A. E. Jacobsen. *Ind. Eng. Chem.*, 1936, **28**, 403.—This paper records a fairly comprehensive experimental survey of two-coat paint systems. A technique is employed which permits the removal of paint films from metal panels which have been subjected to various periods of exposure. The paints used in the experiments recorded were selected with a two-fold objective: (*a*) to determine whether fundamental generalizations might be developed in connection with the behaviour of two-coat systems and (*b*) to investigate the behaviour of the new pigment, lead titanate. By the use of a two-coat system and a physical examination of the detached films after exposure, various relationships between physical properties of the two films, in terms of exposure results, are obtained. The films were tested for distensibility, flexibility, and tensile strength,

and the results obtained are tabulated with reference to failure, as ordinarily observed in paint testing on metal panels. The results obtained in this work indicate the desirability of using specialized paints as undercoats for general house painting, and lead to definite formulation principles which promise improvement in results as compared with general practice. The work has not yet progressed sufficiently to allow generalizations with respect to primers being put forward, but a few conclusions are recorded. The tests are being continued to the point of ultimate failure of the several paints under examination, when a further report will be prepared. H. E. T.

542.48 : 665.5 : 606.3

682. Patents on Analysis. J. Schmidlin. E.P. 444,014, 9.3.36. Improved process and apparatus for the fractionation and distillation of mixtures of substances. W. S. E. C.

Refining and Refinery Plant.

66.046.8

683. Welding of Pressure Vessels. S. F. Dorey. *J.I.P.T.*, 1936, **22**, 211–223.—A paper, presented for discussion, and mainly intended to direct attention to some of the important factors concerning the welding of pressure vessels arranged under the headings: the parent plate material, the electrode, welding technique, residual stress and stress relieving, and testing and inspection. G. R. N.

66.046.8

684. Training of Electric Welders. W. G. Poole and R. T. Rolfe. *J.I.P.T.*, 1936, **22**, 233–246.—A paper, presented for discussion, giving notes on the requirements of good practice, the training of welders and a comparison of methods of training together with an appendix giving typical results of tests on welders. G. R. N.

66.048.3

685. Amplified Distillation. A. C. Bratton, Jr., W. A. Felsing, J. R. Bailey. *Ind. Eng. Chem.*, 1936, **28**, 424.—The efficiency of separation of binary mixtures may often be increased by the addition before distillation of 15–20 volumes of an inert carrier solvent. The solvent should have a uniform boiling range covering that of the components of the mixture, and be structurally dissimilar to the substances to be separated. It is also essential that the substances should be capable of being removed from the solvent by some such means as solvent extraction. The process is explained as being due to the formation of constant-boiling mixtures, and methods are given for predicting the efficiency of any carrier. The method is specially useful as a micromethod, and is illustrated by experimental results on various binary mixtures using hydrocarbon oils as carriers. P. D.

66.048.3

686. Rectification of Binary Mixtures. W. K. Lewis, Jr. *Ind. Eng. Chem.*, 1936, **28**, 399.—The simple conception of a bubble plate assumes that the liquid is perfectly mixed and is of uniform composition throughout. In practice there is a concentration gradient across the plate, which depends on the type of path in which the liquid is caused to flow. Various possible cases are examined mathematically and it is shown that with suitable flow arrangements the plate efficiency as usually defined becomes higher than the local "Murphree" efficiency. The results are shown graphically, and it is shown in a particular case that a separation requiring 40 plates on which the liquid is completely mixed requires only 20–27 plates when the flow is correctly controlled. P. D.

66.048.5

687. Vacuum Equipment in the Oil Refinery. Parts I and II. C. T. Chave. *Refiner*, 1936, **15**, 45–50, 98–103.—Continuous vacuum distillation is applied to: (1) the two-stage distillation unit running to asphalt or cylinder stock, (2) the vacuum flash-tower for both reduced crude and cracked residue, (3) the re-running of treated pressure

distillate, and (4) the fractionation of solvent treated and deasphaltized stocks. Vacuum distillation is practical when the distillate has a low vapour pressure at circulating water temperature and the proportion of non-condensable gases is low, so they can be pumped from the system economically. Line diagrams and short descriptions are given of a vacuum reduced crude unit, vacuum tower with direct contact condensing section, two-stage wet vacuum-pressure distillate re-run unit, vacuum flash-tower with booster ejector, the vacuum condensation process and steam-jet ejectors. The fundamental principle of the design of ejectors is the proper location and arrangement of the nozzles, so as to get an effective impact of the steam with the gas pumped. The length of the diffuser, its shape, and the nozzle location with respect to the throat are very important. Owing to the trial and error methods used in their design there are surprising differences in the guaranteed steam consumption of ejectors. It is necessary to supply constant pressure steam to an ejector, a drop of 10% below designed initial pressure may cause it to stop. An ejector cannot be throttled, otherwise there is a loss of vacuum. Examples are given for calculating the ejector load for vacuum distillation of reduced crude and for pressure distillate.

In Part II line diagrams and short accounts are given of hydraulic arrangements of mixture condensers, barometric condensers, (i) with restricted vapour flow area, (ii) with large vapour-flow area, (iii) with a non-clogging spray and a unit condenser with tray to absorb oil from the steam, as well as graphs of the performance of barometric condensers. A few of the typical troubles of vacuum equipment are oil in the discharge water, hunting of the ejectors, sudden loss of vacuum, gradual reduction of vacuum over a period of months, and little improvement in vacuum due to increased circulating water or lower-temperature circulating water. Methods of alleviation are described.

G. R. N.

66.092.8

688. Pressure Distillate Stabilizer System. J. C. Albright. *Refiner*, 1936, **15**, 90–93.—The new P.D. stabilizer unit of the Wilcox Oil and Gas Co. consists of three columns, one called the stripper tower in which the heaviest ends (about 15% on cracking stock) of the P.D. is conditioned for use as absorption oil. Another the main column, which is two columns, one superimposed upon the other, and which functions as a stabilizer and absorber simultaneously, whilst the third column is the final fractionator where the P.D. stream is reduced to the required vapour pressure. The unit is designed and located so that it can be readily operated by the cracking plant personnel.

G. R. N.

66.094.57

689. Desulphurization of Petroleum Fractions from Ischimbajewo Crude by Means of Hydrogen under Pressure. P. W. Putschkow. *Petr. Zeit.*, 8.4.36, **32** (15), 1–7.—Previous work on the destructive hydrogenation of Mazout (residue above 300°), showed that the petroleum fractions could be desulphurized in the presence of molybdenum sulphide as catalyst at a temperature of 400° C. and under pressures of 30–130 atmospheres.

The present work was carried out on a continuous scale to find out the best conditions for the production of benzine fraction to 200° C. of sulphur content not above 0·1%, and of a (petroleum) fraction (above 200° C.) of sulphur content not above 0·125%; also to investigate the principal factors involved in the hydrogenation, *e.g.* yields of liquid products and gases, hydrogen consumption and the change in composition of the products during the process.

The initial material used was the fraction obtained by steam distillation of Ischimbajewo crude representing 48% by wt. It contained only 6·5% of constituents distilling to 100° C. and had an end-point of 325° C. Molybdenum sulphide on silica gel was used as catalyst in the hydrogenation process, and the product obtained after hydrogenation was submitted to an Engler distillation, the fraction distilling to 200° C. constituting the benzine fraction. The distillate was treated with 10% soda solution and the sulphur content determined by the lamp method.

In order to determine the optimum temperature for desulphurization, 100 atm. pressure was used at temperatures of 380°, 400° and 420° C. Desulphurization occurred at all three temperatures, but it was weaker at 380° than at 400°, and the vaporization

of the product was not complete, about 3% remaining in the heater and 0·5% condensed in the reactor. The (petroleum) fraction obtained when working at a temperature of 430° C. also had a high sulphur content.

The influence of pressure was next investigated, employing 25–100 atm. pressure at 400° C. with a velocity of 2·5 litres/hr. of the product and a gas circulation of 45 litres/hr. When the increase in the pressure of hydrogen was uniform, the sulphur content decreased. Desulphurization was satisfactory at 25 atm. (400° C.) for the benzine fraction, and a higher pressure of 50 atm. was necessary for the fraction above 200° C.

It was also shown that an increase in the velocity of throughput of the initial material resulted in a uniform increase in the sulphur content.

The circulation gas contained only very small quantities of unsaturated hydrocarbons and about 3% of saturated hydrocarbons. The gas from the hydrogenation process contained significant quantities of saturated hydrocarbons in all cases.

Chemical analysis of the benzine by Nametkin's method and for naphthenes, and paraffins by difference were carried out, and it was found that the chemical composition was very little changed at 25 atm. Both the original and the treated samples contained significant quantities of unsaturated constituents, including styrol, and hydrogenation caused an increase in the aromatic content, giving compounds with saturated side-chains. The content of naphthenic and paraffinic hydrocarbons remained practically constant. It was observed at 400° C. and under hydrogen pressures up to 100 atm. that practically no hydrogenation of aromatic hydrocarbons occurred.

The catalyst used remained stable. The gas yield amounted to 1–1·5% by wt., the hydrogen consumption in the desulphurization was 0·25–0·30% by wt. calculated on the initial product, and the yield of desulphurized products 96–99% by volume.

W. S. E. C.

66.048.3 : 668.3

690. Patents on Refinery Plant. M. R. Fenske. U.S.P. 2,037,316, 14.4.36. An improvement in fractionating towers is described for separating mixed vapours into their components.

66.048.7 : 668.3

W. M. Fraser. U.S.P. 2,038,103, 21.4.36. Distilling apparatus for oil passing through under pressure. A pair of opposed orifices is interpolated, which causes a reduction in pressure within the tube without interrupting the flow of oil through the tube. A vapour collecting-chamber is placed between the orifices, and a means is provided for leading the collected vapours away.

66.093.6 : 668.3

T. H. Jackson. U.S.P. 2,039,003, 28.4.36. Apparatus for the dehydration of tar emulsions obtained as a by-product in the manufacture of water gas. W. S. E. C.

Cracking.

66.092

691. Photo-electric Cell Increases Sensitivity of Potentiometer Operation. Anon. *Nat. Petr. News*, 11.3.36, **28** (11), 42.—The application of the photo-electric cell in the operation of a flow controller as used on a cracking plant is described. H. G.

66.092 : 66.048

692. An Economic Comparison of Coking and Cracking. W. L. Nelson. *Refiner*, 1936, **15**, 85–89.—Coking and cracking are compared from an economic standpoint, in order to isolate the factors that most greatly affect cost of coking-plant operation, to determine what market conditions are favourable for coking, and to determine when coking becomes unprofitable. By the use of empirical equations relating profit to the value of the products and the costs of the operation of a coking or a cracking plant, it is possible to derive an expression for the value of the gasoline involving only the A.P.I. gravities of the charging stock and fuel oil and the value of the fuel oil. A

second expression is given, involving the A.P.I. gravities of the charging stock and the fuel oil and the values of the gasoline and fuel oil, which is positive when cracking is profitable and negative when coking is profitable. These equations are also graphically set out. G. R. N.

66.092.14

693. Shukhov–Kapelyushnikov Cracking Unit. I. Andreev. *Neft.*, 1934, **5** (5), 9–11.—A vapour-phase cracked gasoline was subjected to reforming by passing it through a Shukhov-Kapelyushnikov cracking unit, which yielded a gasoline with an octane number of 110 composed of 73% aromatics, 20% unsaturates, 5% naphthenes and 2% paraffins. Amyl and butyl alcohols were prepared from the cracked gases and formaldehyde was obtained by oxidizing the latter. For. Petr. Techn.

66.092 : 608.3

694. Patents on Cracking. Stand. Oil Dev. Co. and W. K. Lewis. E.P. 443,879, 9.3.36. Cracking of residual oils under mild conditions of temperature and pressure and uniting cracked oil with that obtained from the cracking of a light cycle gas oil cracked under more strenuous conditions. The combined streams are further cracked and fractionated, and the light cycle gas oil is returned for strenuous cracking to obtain pitch and a heavy gas oil containing light tar; heavy gas oil is further cracked, the light tar separated and blended with the pitch.

66.092.8 : 608.3

J. K. Roberts. U.S.P. 2,032,666, 3.3.36. Stabilization of pressure distillate to give products containing butane, propane, pentane and hexane.

66.092 : 608.3

D. L. Jacobs and E. M. Dons. U.S.P. 2,032,846, 3.3.36. Method and apparatus for cracking hydrocarbons.

66.092 : 608.3

C. B. Weston. U.S.P. 2,032,861, 3.3.36. The anti-knock value of gasoline is increased by a mild form of cracking in the vapour phase and subsequent fractionation and condensation.

66.092 : 608.3

J. D. Seguy. U.S.P. 2,032,892, 3.3.36. Cracking of hydrocarbon oils first in the liquid phase and then in vapour phase and combining the vapours from both operations.

66.092 : 608.3

P. C. Keith, Jr. U.S.P. 2,033,472–2,033,473, 10.3.36. Improvement described in the method of cooling vapours in the fractionator and vaporizer of a cracking apparatus.

66.092 : 608.3

W. T. Hancock. U.S.P. 2,034,094, 17.3.36. Improved form of cracking still.

66.092 : 608.3

E. F. Nelson. U.S.P. 2,034,526, 17.3.36. Cracking of hydrocarbons containing olefins in a heating coil of a cracking system and converting the higher-boiling oils in a separate heating coil of the same system. The resultant conversion products from both heating coils are blended.

66.092 : 608.3

O. G. Pratt. U.S.P. 2,034,989, 24.3.36. Two streams of crude oils of different specific gravities are treated simultaneously to remove natural gasoline, and additional quantities of gasoline hydrocarbons are obtained from the residue by cracking them in admixture with synthetic crude obtained from a cracking operation.

66.092 : 608.3

M. P. Youker. U.S.P. 2,035,036–2,035,037, 24.3.36. Conversion of hydrocarbon gases and liquids into new hydrocarbon compounds by cracking in which the production of free carbon is decreased.

66.092 : 608.3

M. P. Youker. U.S.P. 2,035,209, 24.3.36. Production of motor spirit by direct cracking of crude oil.

66.092.14 : 608.3

I. M. Levine. U.S.P. 2,035,239, 24.3.36. Vapour-phase cracking apparatus utilizing two expander tanks connected in series.

66.092.14 : 608.3

G. M. Pfau and H. H. Pruitt. U.S.P. 2,035,275, 24.3.36. Improved expander for use in vapour-phase cracking operations.

66.092.4 : 608.3

W. F. Faragher and E. J. Houdry. U.S.P. 2,035,467–2,035,468, 31.3.36. Cracking of hydrocarbon oils using two catalysts in succession which are capable of regeneration *in situ*.

66.092.4 : 608.3

E. J. Houdry. U.S.P. 2,035,478, 31.3.36. Catalytic cracking of hydrocarbons to produce motor fuel.

66.092 : 608.3

D. Pyzel. U.S.P. 2,035,506, 31.3.36. Improved gas cooler for cracking hydrocarbons.

66.092 : 608.3

W. T. Hancock. U.S.P. 2,035,547, 31.3.36. Refining of petroleum in two stages: first heating to below cracking temperature, and then heating to cracking temperature to convert the vapours unvaporized in the first stage, and combining the vapours from both stages for fractionation to recover the gasoline.

66.092.12 : 608.3

A. D. Smith. U.S.P. 2,035,727, 31.3.36. Cracking of hydrocarbon oils in the liquid phase, and then in the vapour phase, in order to increase the octane number.

66.092.4 : 608.3

J. C. Morrell. U.S.P. 2,035,910, 31.3.36. Cracking of coals, pitch or bituminous materials to produce gasoline, in which a gas containing free oxygen is used as catalyst to form condensable partial oxidation products. Generally, lower temperatures and pressures may be employed in the presence of catalysts.

66.092 : 608.3

G. C. Hargrove. U.S.P. 2,036,965, 7.4.36. Cracking of hydrocarbons to increase the yield of gasoline by increasing the conversion and reaction periods, while maintaining a relatively low recycle ratio.

66.092 : 608.3

W. F. Moore. U.S.P. 2,036,968, 7.4.36. Liquid from the reaction stage in a cracking process is introduced into the coking stage at an elevated point, and preferably in an atomized condition, and mixed with a portion of high-pressure vapours from the reaction stage. The removal of volatile material is then facilitated.

66.092 : 608.3

L. C. Huff. U.S.P. 2,037,238, 14.4.36. Cracking of hydrocarbons to increase the gasoline yield. The reflux condensate is stripped of light fractions before returning to the heating coil to be again raised to conversion temperature.

66.092 : 608.3

E. C. Herthel. U.S.P. 2,037,379–2,037,380, 14.4.36. Cracking apparatus provided with an auxiliary heating and cracking coil to increase the efficiency and capacity of the still.

66.092.123.6 : 608.3

A. V. Ritchie. U.S.P. 2,037,537, 14.4.36. Improvement described in the method of handling the charge entering a continuous cracking system. The refluxed material is introduced after it has been independently preheated, at a point in the system where the heavier oils are collected.

66.092 : 608.3

W. H. Bahlker and W. G. Whitman. U.S.P. 2,037,674, 14.4.36. The majority of heavier constituents which are not adapted for cracking with fresh cracking stock are stripped from the heavy condensates in a cracking system by introducing water before they are withdrawn from the lower portion of the vapour fractionating-column.

66.092.5 : 608.3

J. D. Seguy. U.S.P. 2,037,933, 21.4.36. Hydrocarbons are cracked in a primary zone, the vapours dephlegmated, condensed and the unvaporized oil hydrogenated to separate motor fuel constituents. The heavier constituents from the hydrogenation process are passed to a secondary cracking zone using higher pressures and lower temperatures, and cracked under independently controlled cracking conditions. The vapours are removed, and the residue from the secondary cracking zone is hydrogenated.

66.092 : 608.3

R. F. Trow. U.S.P. 2,037,952, 21.4.36. Cracking process to produce only a small quantity of gas and a relatively heavy pitch as residue.

66.092 : 608.3

C. B. Watson and C. L. Smith. U.S.P. 2,037,953, 21.4.36. Combined vapour and liquid phase cracking to produce high gasoline yields and reduced quantities of fuel oil of low viscosity.

66.092 : 608.3

C. W. Watson. U.S.P. 2,039,239, 28.4.36. Cracking of hydrocarbon oils to produce gasoline which is subjected in a freshly formed or nascent condition to fractionation. A vapour fraction of desired boiling range is obtained, which is immediately contacted with a suitable adsorbent catalyst. W. S. E. C.

Hydrogenation.

66.094.17 : 608.3

695. Patents on Hydrogenation. H. E. Potts and Int. Hydrogn. Patents Co., Ltd. E.P. 444,779, 27.3.36. Destructive hydrogenation of carbonaceous substances in the presence of a catalyst containing iron sulphide prepared by treating precipitated iron sulphide with hydrogen sulphide at 200–400° C.

66.094.1 : 608.3

H. E. Potts. E.P. 444,936, 31.3.36. Regulation of temperature in the hydrogenation of carbonaceous substances in the gaseous phase at 300–550° C. and under at least 50 atm. pressure. A quantity of ammonia amounting to 5–30% of the hydrogenating gas is admixed with the hydrogen. The catalyst is a heavy metal of the sixth group of the periodic system, *e.g.* tungsten disulphide.

66.094.1 : 608.3

International Hydrogenation Patents Co., Ltd., and I.G. Co. E.P. 443,937, 10.3.36. An improvement is described in the control of the reaction temperature in the destructive hydrogenation of distillable carbonaceous substances in which the reaction vessel is subdivided into consecutive compartments each separated by a zone.

66.094.173 : 608.3

M. Pier, P. Jacob and W. Simon. U.S.P. 2,038,599 and 2,039,259, 28.4.36. Destructive hydrogenation of carbonaceous substances at 300–700° C. and under superatmospheric pressure employing as catalyst a sulphide of a heavy metal other than iron which is capable of forming a thio-salt. The catalyst is prepared by treating a heavy metal with a sulphidizing agent, *e.g.* sulphur dioxide, at 150–170° C., free hydrogen being added in a quantity not above 10% of the entire amount of volatile constituents, and treating the agent under 2 atm. pressure until no further sulphur is absorbed from the sulphidizing agent by the material being treated. W. S. E. C.

Polymerization.

66.095.26

696. Kinetics of Polymerization Processes. Part II. G. Gee. *Trans. Faraday Soc.*, 1936, **32**, 656.—The discussion of the kinetics of a polymerization chain is continued from Part I, and extended to cases where chain-breaking mechanisms are operative. The paper opens with a few notes on the relationship between the results of the two methods of mathematical analysis as developed by the author and by Dorstal and Mark (*Z. physik. Chem.*, 1935, **29B**, 299; *Trans. Faraday Soc.*, 1936, **32**, 54). A discussion of the behaviour of polymerization processes in which the growth of chains is terminated in various ways is now given. The cases considered include: (*a*) spontaneous deactivation, (*b*) termination of chains by collision with a molecule of monomer, and (*c*) partial deactivation, mathematical expressions being developed for each case. From results obtained it is shown that the fraction polymerized before the maximum velocity is attained varies from zero with strong deactivation to one-third with no deactivation and zero steric factor, and finally approaches a value of one-half for large steric factors.

The application of the analysis to experimental measurements is discussed, actual examples of the various mechanisms being quoted from the literature. H. E. T.

66.095.26

697. Kinetics of Polymerization Processes. Part III. The Effects of Catalysts and Inhibitors. G. Gee and E. K. Rideal. *Trans. Faraday Soc.*, 1936, **32**, 666.—An investigation is carried out on the effects of inhibitors and catalysts on polymerization processes proceeding according to the mechanisms discussed in Part II. The effect of an inhibitor on the velocity of a polymerization reaction and the size of the polymers produced is first examined, and it is shown that the usual assumption that these are diminished in the same ratio is not strictly accurate, but is nevertheless a good approximation in the early stages of the reaction. The mechanism of catalysis is then examined, and two possibilities which present themselves are discussed, these are: (*a*) the catalyst initiates chain centres, (*b*) the catalyst forms a reactive complex. Of these two possibilities (*a*) is incapable of adequately explaining the results observed by various workers, whilst (*b*) is capable of explaining with reasonable exactitude all the experimental observations. H. E. T.

66.095.26 : 608.3

698. Patents on Polymerization. I.G. Co. E.P. 440,957, 9.1.36. Manufacture of stabilized polymerization products which do not lose hydrohalic acid and are rendered more suitable as substitutes for caoutchouc. Halogenated diolefines and ethylene dioxide derivatives are heated in an indifferent solvent of high b. p., *e.g.* toluene or xylene at 100° C., a small quantity of a stabilizing agent is then added.

66.095.26 : 608.3

F. W. Sullivan, Jr. U.S.P. 2,031,987, 25.2.36. Polymerization of unsaturated hydrocarbons, the heat evolved being utilized to heat another hydrocarbon fluid, *e.g.* conversion of gas oil into lower-boiling fractions. Molten metal is used as a heat transfer medium.

T

66.095.26 : 608.3

Beck, Koller & Co. and W. Krumbhaar. E.P. 444,440, 20.3.36. Production of polymerized drying or semi-drying oils. Cobalt, manganese or iron is electrically dispersed in an oil-miscible organic medium, *e.g.* butyl alcohol or turpentine, and the resulting colloidal dispersion is heated with the oil until a viscous oil is obtained.

[66.095.26 : 608.3

R. E. Ruthruff. U.S.P. 2,038,086, 21.4.36. Polymerization of olefinic gases at elevated temperatures and pressures. The gases are passed into a confined zone of a heating section of a furnace, heated rapidly to reaction temperature and passed into a soaking zone. A current of air is maintained in flow external to the zone, so that the air is preheated and then passed into a heating section of the furnace.

66.095.26 : 608.3

F. E. Frey. U.S.P. 2,038,834, 28.4.36. Conversion of volatile aliphatic hydrocarbons higher than methane, *e.g.* natural gas and gases from cracking plants from the destructive distillation of bituminous materials, into motor fuel. The hydrocarbons are heated at 750–1200° F. and under 500–5000 lb. pressure/sq. in. to effect polymerization; the normally liquid hydrocarbons are separated from the normally gaseous hydrocarbons and the latter are separated into two fractions. One fraction containing hydrocarbons lighter than the principal constituent of the charging stock is freed from methane and then passed through another heating zone heated to 1250–1750° F. and under 500 lb./sq. in. pressure, to give a yield of aromatic hydrocarbons which are recovered. The other fraction, containing gases of the same boiling range as the charging stock, is returned to the heating zone for further treatment.

W. S. E. C.

Motor Fuels.

662.753.1

699. Survey of Winter Motor Fuels. W. T. Ziegenhain. *Oil & Gas J.*, 5.3.36, **34** (42), 15.—Samples taken from the company-owned filling stations of a number of the principal oil companies in Cleveland, Chicago, Kansas City, Fort Worth and Tulsa have been analysed. The properties determined include A.S.T.M. distillation range, Reid vapour pressure and octane number. From these data the average properties of the Regular, Premium and Third-grade spirits are deduced. A table has been prepared to show the average properties of the three grades sold in the winter of each of the years 1932–1936. This table shows that the volatilities of the 1936 grades are similar to those of 1935; Reid vapour pressures of all grades show a general progressive increase since 1932; octane numbers remain substantially the same as for 1935. The principal features of the 1936 averages are :—

Grade.	Regular.	Premium.	Third.
I.B.P. (° F.) . . .	87	91	99
20% over at ° F. . .	155	153	185
50% over at ° F. . .	236	223	257
F.B.P. (° F.) . . .	406	392	416
Reid V.P. (lb.) . .	11·1	10·2	8·0
Octane number . .	69	76	51

R. A. E.

665.521.2

700. Gum in Cracked Gasoline. J. C. Morrell, C. G. Dryer, C. D. Lowry, and G. Egloff. *Ind. Eng. Chem.*, 1936, **28**, 465.—Three typical cracked gasolines from Pennsylvania, West Texas and California were subjected to varied degrees of oxidation both by accelerated ageing and by storage in contact with air. The properties of the oxidized gasolines were determined, and also the distribution of

oxidation products in the light and heavy distillates, and in the residue obtained from each sample by vacuum distillation.

After accelerated ageing, the peroxide content was greatest in the vacuum residue, whilst the acid content was greatest in the light distillate; the aldehyde concentration was evenly distributed. For stored gasoline, however, all oxidation products showed a concentration in the vacuum residue.

The authors conclude that peroxides represent the initial stage, and are essential factors in gum formation, being present in larger amount in oxidized gasoline than other oxidation products. Peroxides concentrate in the gum to a much greater extent than do the aldehydes and acids, although, since the gum isolated always contains aldehyde and acid, it is possible that these have some significance in gum formation, particularly in the gum precipitated from gasoline during oxidation, which has a high acid content.

F. E. A. T.

665.542

701. Chemical Processes in the Refining of Petroleum Distillates. J. C. Morrell and G. Egloff. *Nat. Petr. News*, 18.3.36, **28** (12), 33; 25.3.36, **28** (13), 24*a*.—A review of the present-day knowledge with regard to the composition of gasoline and the chemical reactions involved in the refining of that commodity is presented. Cracked distillates are dealt with more particularly. The composition of gasoline is still incompletely understood, but the application of more refined methods of fractional distillation, etc., by recent workers has isolated in straight-run gasoline, paraffinic hydrocarbons from methane to *N*-decane, naphthenic hydrocarbons from *cyclo*pentane to nonanaphthene, and aromatic hydrocarbons from benzene to mesitylene. Sulphur is present in very varied combinations. Crudes vary considerably in their nitrogen content, from 0·008% total nitrogen in Pennsylvanian oils to as much as 2·3% in some Californian oils. The latter figure represents some 30% of nitrogen compounds. The various chemical methods for the determination of olefins, naphthenes and aromatics are reviewed. Most of them are based on the differential action of sulphuric acid or nitrating acid of some particular strength. In the Kattwinkel method, stated to be rapid and reliable, advantage is taken of the fact that concentrated sulphuric acid containing a small percentage of boric acid removes olefins only while concentrated sulphuric containing P_2O_5 reacts with both olefins and aromatics. Very little work has been done on the identification of the hydrocarbons in cracked distillates. The composition of these distillates appears to be largely a function of cracking conditions. The action of sulphuric acid used in refining is dealt with at some length. Four types of bodies are formed during the treatment, viz. esters, alcohols, polymers and oxidation products. The extent to which any reaction takes place depends on the type of distillate, the concentration and amount of acid and the temperature. Loss during treatment is due to solution of distillate in the sludge and to polymerization. Treating at low temperature has many advantages, the minimizing of loss being a prominent one. Polymerization appears to be a function of the temperature and to decrease in extent with decrease of washing temperature. The mechanism of gum formation has received much attention. Gumming appears to be initiated by the formation of peroxides due to the oxidation of olefins. The tendency to oxidize depends on the position of the double bond. Diolefins containing conjugated double bonds tend to oxidize much more readily than olefins of other types. The rate of oxidation increases with time. The presence of peroxides leads to the formation of aldehydes and acids and "gum," but there is no reliable evidence that the former two bodies are intermediates of the latter. A study of the causes and mechanism of colour instability has led to the conclusion that the yellow colouring-matter in cracked distillates is due to the presence of hydrocarbons containing conjugated unsaturated groups or diolefins of the conjugated type. SO_2 and sulphuric acid present as a natural constituent or formed during refining processes are a frequent cause of the formation of colour and "haze" on exposure to light. Inhibitors used to achieve colour stability usually contain phenolic or aromatic amine groups, and are most effective if both groups are present.

H. G.

665.582.2

702. Synthetic Petrol. Fischer Process for France. Anon. *Chem. Trade J.*, 1936, **98**, 286.—A licence for the manufacture of synthetic petrol by the German Fischer

patent has been acquired by the Société des Produits Chimiques Courrières–Kuhlmann. Production at the rate of 25,000 tons per annum is probable before the middle of next year. Constructional costs of the plant are estimated at about 40 million francs. Four plants utilising this process are under construction in Germany. R. A. E.

665.591.4.047.7

703. Vapour Recovery and Treating Units. Anon. *Refiner*, 1936, **15**, 123–124.—Topped crude, in a Cushing, Okla., refinery, is used as absorption oil in the vapour-recovery system as well as charging stock to the Dubbs cracking plant. This simplifies the operation, insomuch as recovery of the absorbed gasoline can be attained by means of the cracking unit itself, and lowers the cost. The recovered plus cracked gasoline is stabilized in the usual way, then treated with doctor in a simple continuous plant, consisting of two horizontal and one vertical vessels in series for contacting and separating. The finished gasoline, which is sweet, non-corrosive and 30 + Saybolt colour, is inhibited. The average all-in treating cost is given as five cents per brl. G. R. N.

621.056.5 : 608.3

704. Patents on Motor Fuels. A. C. G. Egerton. E.P. 443,562, 2.3.36. A method of accelerating ignition and for promoting combustion of fuel in internal-combustion engines is described in which 1% by wt. of an alkyl or alkyl acyl peroxide, *e.g.* diethyl peroxide, is introduced into the combustion chamber.

665.521.33 : 608.3

E. V. Bereslavsky. E.P. 444,026, 11.3.36. Anti-knock motor fuel, consisting of 85% of petrol, 10% of anhydrous ethyl alcohol and 5% of pine oil, which has been pretreated with pyrogallol to inhibit gum formation.

665.581.5 : 608.3

Ruhrchemie. A.G. E.P. 444,315, 16.3.36. Production of gaseous fuel from coke-oven gases containing 20–30% of ethane and ethylene, 30–40% of propylene and butylene and 30% of propane, butane and pentane; the gases are admixed with benzene.

665.521.2 : 608.3

E.I. Du Pont de Nemours & Co. E.P. 444,585, 23.3.36. Stabilization of motor spirit to inhibit gum formation with a compound of the general formula $HO–R–N<\begin{matrix}CH_2–CH_2\\CH_2–CH_2\end{matrix}>O$, in which R is an arylene nucleus, *e.g.* phenylene, naphthylene, diphenylene, in which R may carry one or more hydrocarbon substituent groups.

665.521.2 : 608.3

A. E. Pew, Jr., B. Maur and H. Thomas. U.S.P. 2,036,358, 7.4.36. Recovery of low-boiling hydrocarbons from cracked products. The outflowing gasoline is divided into two streams; one stream is refined with or without the removal of a minor proportion of heavy ends, and the other stream is condensed without refining and without removing heavy ends, and is returned to the upper part of the refluxing tower and utilized as main or sole refluxing liquid.

665.521.2 : 608.3

L. P. Chebotar. U.S.P. 2,036,396, 7.4.36. Removal of sulphur and gum-forming constituents from gasoline or kerosene by adding 0·1% of pyridine and 0·05% of copper naphthenate and then contacting the resulting product with air at 60–100° C.

662.758.2 : 608.3

E. Livraghi. U.S.P. 2,037,478, 14.7.36. Production of anti-knock motor fuel for explosion engines; 40–60% by wt. of synthetic methyl alcohol is mixed in the cold

with 60–40% of light oils, crude benzenes and other hydrocarbons obtained by distillation of coal together with 2% of naphthalene. The proportions are added to sum up to 100%, the mixture is distilled and the resulting vapours are subjected to thermal cracking at 350–500° C., according to the required cracking temperature for the distilled vapours.

665.521.2 : 608.3

A. V. Grosse. U.S.P. 2,037,781, 21.4.36. Removal of sulphur compounds from cracked distillates by subjecting them to the action of hydrogen at 500–700° F. in the presence of 85–95% of cobalt thiomolybdate and 5–15% of sodium aluminate as catalyst.

665.521.2 : 608.3

V. Ipatieff. U.S.P. 2,037,789, 21.4.36. Reduction of sulphur content of motor fuels, *e.g.* cracked gasolines, by treatment with hydrogen in the presence of zinc oxide and sodium aluminate.

665.521.2 : 608.3

V. Ipatieff. U.S.P. 2,037,790, 21.4.36. Treatment of motor fuels as described in the previous patent, utilizing an oxide of a metal of group two of the periodic system at 400–800° F. and under a hydrogen pressure of 150–450 lb./sq. inch.

665.521.2 : 608.3

V. Ipatieff. U.S.P. 2,037,791, 21.4.36. Treatment of motor fuels as described above, the catalyst being nickel thiomolybdate and sodium aluminate.

665.521.2 : 608.3

V. Ipatieff. U.S.P. 2,037,792, 21.4.36. Treatment of motor fuels as described above, the catalyst being a mixture of 50% of nickelous oxide, 40% of molybdenum oxide and 10% of sodium aluminate.

665.521.2 : 608.3

E. G. Ragatz. U.S.P. 2,038,314, 21.4.36. Recovery of natural gasoline from natural gas utilizing an absorption oil and fractionating the absorption oil containing gasoline in two fractionating columns, one under high pressure and one under low pressure.

665.521.2 : 608.3

E. G. M. R. Legé. U.S.P. 2,038,360, 21.4.36. Partial oxidizing carbonization of hydrocarbons, *e.g.* gas oil by the action of sulphuric acid (48–66° Bé), and maintaining the hydrocarbons in the presence of excess sulphuric acid at 150–250° C. Steam is injected into the reaction mixture to produce partial oxidizing carbonization, and the transformed hydrocarbons are collected.

665.521.2 : 608.3

D. R. Stevens and W. A. Gruse. U.S.P. 2,038,614, 28.4.36. Removal of gum-forming constituents from gasoline by heating the gasoline, in the absence of catalysts and of added hydrogen, to temperatures very much higher than the normal vaporizing temperature, but low enough to avoid cracking, for 30 mins., under 1000 lb. pressure/sq. inch.

665.521.2 : 608.3

Univ. Oil Prod. Co. and A. L. Mond. E.P. 444,894, 26.3.36. Gum-formation in motor fuel containing unsaturated hydrocarbons is inhibited by adding a lignite-tar fraction distilling between 230° and 280°, and in an amount less than 2% of the motor fuel.

W. S. E. C.

Lubricants and Lubrication.

621.891

705. Metallic Wear in the Presence of Lubricants. *Nature*, 1936, **137**, 519–521.—An account of a paper contributed by Dr. Brownsdon at a general discussion on this subject organized by the Institute of Metals.

A machine was constructed for making rapid comparative tests of this phenomenon. It consisted chiefly of a hardened steel wheel about 1 in. in diameter, rotating in contact with flat samples of the metals under investigation, under known conditions of load, speed, lubrication, time and temperature. A measure of the amount of wear was given by the length of the oval impression made on the sample.

It was found that the results obtained with a particular alloy when using (1) a mineral oil and (2) a soap solution may vary considerably, and the value of a lubricant as a preventitative of wear cannot be completely determined apart from the metals or alloys with which it is used. The value of additions such as oleic or stearic acids to a straight mineral oil was demonstrated.

Experiments showed that when a straight mineral oil was used, the behaviour of cupro-nickel was better than that of the brasses, whilst the reverse was the case when using castor oil of the same viscosity.

In the discussion which followed it was pointed out that high adhesion of the oil to the metal tends to prevent wear.

This method of testing was subjected to severe criticism mainly on the ground that conclusions reached from the test were not in agreement with results of long practical experience. However, it is stated that the test has proved of value in the examination of extreme pressure lubricants. D. L. S.

621.892.25

706. Structure of Lubricating Greases. B. B. Farrington and W. N. Davis. *Ind. Eng. Chem.*, 1936, **28**, 414.—The fine structure of lubricating greases has been investigated by means of photomicrographs taken with dark-field illumination. The classification of the greases is carried out by means of the soap fibre length, the soap fibres photographed varying in length from 1 mm. to a fraction of a micron. There are indications that some of the fibres are of ultra-microscopic dimensions. H. E. T.

665.543.061.5 : 608.3

707. Patents on Lubricating Oil. N.V. Bat. Petm. Mij., H. F. Lindike and B. S. Greensfelder. E.P. 444,535, 23.3.36. Solvent extraction of lubricating oil using a solvent mixture comprising a selective solvent (other than furfural and naphthalene) and an effective quantity of diluent, *e.g.* a mixture of benzole, diphenyl and naphthalene.

665.543.061.5 : 608.3

Coutts & Co. and F. Johnson. E.P. 444,244, 13.3.36. Production of lubricating oil by subjecting crude high-molecular paraffin-wax condensation products (obtained by the action of a silent electric discharge as described in E.P. 424,569; cf. Abstr. 579, 1935) to extraction with liquid hydrocarbons of critical temperature below 250° C. The reaction is carried out at temperatures above 25° and up to 50° above the critical temperature, and the resulting product is heated with another selective solvent.

621.892.24 : 608.3

Standard Oil Development Co. E.P. 444,851, 30.3.36. Emulsifiable composition of mineral oil, 7% of an oil-soluble sulphonate derived from petroleum hydrocarbons and 1·5% of triethanolamine oleate.

621.892.2 : 608.3

Standard Oil Development Co. E.P. 444,778, 27.3.36. Preparation of lubricating oil by subjecting aliphatic acids, esters and alcohols of high mol. wt., containing at least 10 carbon atoms, and having an iodine value below 60, to mild oxidation. Gas

which is rich in free oxygen is blown through these compounds at a temperature of 180–200° C., and the oxidation product is then blended with a suitable base. The iodine value of the aliphatic acid may be reduced to below 60 by pretreating it with hydrogen.

665.545.3 : 668.3

Texaco Dev. Corpn., H. H. Gross and W. V. Overbaugh. E.P. 445,172, 3.4.36. Dewaxing hydrocarbon oil, using as dewaxing solvent methyl *iso*butyl ketone in conjunction with solvents, *e.g.* acetone, benzole or light petroleum fractions such as butane, propane and natural gasoline hydrocarbons.

665.545.3 : 668.3

J. A. Anderson. U.S.P. 2,036,188, 7.4.36. Dewaxing of lubricating oils containing slop wax. The oil is diluted with a miscible fluid of relatively low viscosity, the mixture chilled, the wax separated, and distilled under non-cracking conditions to remove the diluent, oil and crystalline wax. The residue when dissolved in wax-bearing oil has the property of preventing precipitation of wax in interlacing crystals.

665.545.3 : 668.3

M. H. Tuttle. U.S.P. 2,036,374, 7.4.36. Dewaxing of lubricating oils using the dewaxed oil as a cooling medium to avoid shock chilling.

665.545.3 : 668.3

L. D. Jones. U.S.P. 2,036,966, 7.4.36. Dewaxing of lubricating oils containing wax which is too crystalline to remove by simple centrifuging or chilling. The wax is separated by centrifuging in subsidence at — 30° F.

665.521.5 : 668.3

F. W. Sullivan, Jr. U.S.P. 2,036,973, 7.4.36. Fields of lubricating oil from mixed base petroleums are increased by treating with concentrated sulphuric acid ($\frac{1}{4}$ lb. of acid/gallon of petroleum) to give an oil layer and a sludge. The oil layer is recovered and the sludge heated to 400–500° F. to remove sulphur and sulphuric acid compounds, and the acid sludge residue hydrogenated.

665.543.061.5 : 668.3

M. R. Fenske and W. B. McCluer. U.S.P. 2,037,318, 14.4.36. Method and apparatus for contacting liquid phases, *e.g.* solvent extraction of lubricating oils. The liquids flow through the zone of contact over longitudinally arranged attenuated packing chambers.

665.543.061.5 : 668.3

M. R. Fenske and W. B. McCluer. U.S.P. 2,037,319, 14.4.36. Solvent extraction of lubricating oils using at least two solvents.

665.543.061.5 : 668.3

R. E. Manley and H. H. Gross. U.S.P. 2,037,385, 14.4.36. Solvent extraction of lubricating oils using furfuryl acetate.

665.521.5 : 668.3

H. A. Curtis. U.S.P. 2,037,563, 14.4.36. Production of lubricating oils of low pour point by admixing the oil with the material adsorbed from residual cylinder stock by adsorbent earth, and which is removable from the earth by washing with ethanol.

665.521.5 : 668.3

L. H. Robertson and W. A. Eberle. U.S.P. 2,038,604, 28.4.36. Treatment of residual cylinder oil stocks with clay by a percolation filtration method.

665.545.3 : 608.1

C. E. Adams and F. W. Scheineman. U.S.P. 2,038,624, 28.4.36. Method for the continuous dewaxing of lubricating oils using liquefied propane.

665.545.3 : 608.1

R. E. Burk. U.S.P. 2,038,640, 28.4.36. Dewaxing of lubricating oil containing amorphous wax, by dissolving 5–25% of phenol in the oil, solidifying the phenol in crystalline form and separating the crystallized phenol and precipitated wax from the oil.

665.543.061.5 : 608.1

R. E. Manley. U.S.P. 2,038,798, 28.4.36. Solvent extraction of lubricating oil using furfural and treating the constituents of high paraffin content with concentrated sulphuric acid in an amount equal to 5 lb. of acid/brl. of oil. W. S. E. C.

Fuel Oil.

662.753.322

708. Coal Oil Trials in a Diesel Bus. J. L. Strevens. *Gas & Oil Power*, March 1936, **31** (366), 77.—Comparative tests have been made on two identical omnibuses, one using normal fuel oil and the other coal-oil blend. The vehicles were powered by 36·5 H.P. Gardner 5 L.W. type cold-starting, airless injection engines. Details of the principal engine parts and controls are given. Each vehicle was driven about 420 miles over identical routes. The properties of the fuels used were :—

	Coal-Oil Blend.	Normal Fuel.
Specific gravity . .	0·857	0·851
Visc. R. 1 at 100° F. .	34 secs.	35 secs.
Carbon . . .	0·21%	0·04%
Hard asphalt . .	trace	—
Ash content . .	0·003%	0·0015%
Sulphur . . .	0·27%	0·04%
S.I.T. (oxygen) . .	255/260° C.	250° C.

Results obtained on the coal-oil blend were : m.p.g. 11·7, injection nozzles normal for carbon, slight sludging in both filters ; and on the normal fuel were : m.p.g. 11·27, injection nozzles normal for carbon, both filters normal.

Five drivers reported that the omnibus using coal-oil blend gave good acceleration and power ; smell nil or very slight ; smoke nil in service ; one reporting slight puff only when starting from cold (40° F.). R. A. E.

Asphalt and Bitumen.

665.521.8 : 621.565

709. Use of Bitumen in the Construction of Cold Rooms. H. Hille. *Bitumen*, 1936, **6**, 36–40.—A description is given of the construction of cold rooms for ice-storage, etc., in which bitumen is used as binder for cork blocks, or as jointing, *e.g.* between cork insulating material and concrete. Bitumen paint is applied to the inside of the room, so that ice blocks do not freeze to the masonry. C. C.

665.521.8.063.6

710. Classification of Bituminous Emulsions. A. Stellwaag. *Asphalt u. Teer*, 1936, **36**, 1–10.—The author discusses in detail a publication by the "Association for Investigation of Road Construction Materials" dealing with the use of bituminous emulsions. The properties of emulsions, methods of testing, applications and classification are considered. A. O.

665.521.8.063.6 : 539.61

711. Adhesivity of Asphalt Emulsions to Sand and Mineral Aggregates. J. Jachzel. *Asphalt u. Teer*, 1936, **36**, 101–104.—The author briefly reviews the literature dealing with the breaking of emulsions and adhesion of the deposited bitumen to aggregates, more particularly in connection with the use of emulsion in cold asphalt. Experiments are described in which asphalts were prepared with emulsion and quartz sand, the sand and/or asphalts being treated with materials such as hydrate of lime, metallic salts, weak acids, alkalis, soaps of fatty acids of high molecular weight, rosin solution, etc. The experiments are said to indicate that the fixation of bitumen from emulsion upon quartz sand, granite chippings or concrete cannot be obtained by admixture with limestone powder alone, but suitable treatment enables a firmly adhering coating to be obtained on these materials. In some cases fixation may be obtained by squeezing the water out of the asphalt; moistening the sand with petroleum or tar distillates assists in the coating of the grains with bitumen, but adhesion is obtained more quickly by addition of metallic salts. Admixture with hydrate of lime is even more effective than the addition of metallic salts, and by warming the asphalt after mixing, the binding is accelerated. Many of the materials examined were of little value, whilst soaps, glue, free acids and calcium chloride caused separation of the bitumen. Treatment of the sand with alkali retarded breakdown of the emulsion. A. O.

665.521.8.063.6 : 542.93

712. Estimation of Breakdown of Road Emulsions. W. Geissler and H. Kleinert. *Asphalt u. Teer*, 1936, **35**, 1019–1022, **50**, 1038–1040.—In this article the factors of influence in the breaking of emulsions and methods of determination of rate of breaking are considered. As a result of an examination of the British Lability Test and the Dresden Breakdown Test, the former test is criticized, on the grounds that the end-point is difficult to determine, results differ with variation in the rate of passage of air and with differences in the amount of carbon dioxide, and moisture in the air. The Dresden method, however, is said to permit of the separation of emulsion into three classes, according to the breakdown value obtained on a standard aggregate.

A. O.

665.521.8.063.6 : 542.93

713. Mineral Stability of Bituminous Emulsions. G. H. Klinkmann. *Bitumen*, 1935, **5**, 206–212.—The factors responsible for breaking of emulsion on application are considered and, in the author's opinion, evaporation of water and effect of soluble constituents of aggregate are of little importance compared with changes in the colloidal state of the soap due to the action of the stone. As evidence that evaporation of water has little effect, it is stated that porphyry chippings were dipped in emulsion and exposed on a cold humid day, and while chippings dipped in quick-breaking emulsion developed a shiny black coating in five minutes, chippings dipped in slow-breaking emulsion required 25 minutes to reach the same stage. Details of a method of determining mineral stability or rate of break are given, using an emulsion stabilometer. The emulsion is allowed to flow upwards through glass tubes packed with aggregate of 1 mm. diameter, and the volume which has passed into the tube when the leading surface of the emulsion breaks, as shown by flow of emulsion ceasing, is noted.

Results obtained on a number of emulsions and aggregates are said to confirm the findings of Weber and Bechler that rate of breaking of a given emulsion differs with different aggregates, and that no relationship exists between results obtained with different emulsions on the same series of aggregates. Mineral stability is stated to decrease on ageing of an emulsion. Results of an investigation of the effect of emulsifiers on stone showed that considerable amounts of alkali, and in some cases of soap also, are absorbed by the stone, the amounts differing with different types of stone. The views of Weber and Bechler that freshly broken stone is more active than weathered stones were not confirmed by the author, who points out that the surface of porous weathered stone is much greater than that of smooth freshly broken stone, and also that the former is deficient in basic constituents. It is stated that soap-type emulsions are not suitable for premix work, and that this type of emulsion has been

replaced by emulsion prepared with special emulsifiers which are unaffected by stone, breaking of the emulsion being due entirely to evaporation of water. It is suggested that the suitability of a bitumen for emulsion manufacture may be examined by emulsifying with a given formula and determining the mineral stability of the emulsion thus obtained. A. O.

Special Products.

615.778.75 : 632.951

714. Oil Sprays. R. P. Tucker. *Ind. Eng. Chem.*, 1936, **28**, 458.—The toxicity of petroleum oil sprays to foliage is shown to be due to the formation of asphaltogenic acids in the presence of oxygen and sunlight. Unsaturated hydrocarbons, *per se*, are innocuous, but owing to the readiness with which they oxidize to asphaltogenic acids, the unsaturated content of oil sprays should be kept low; maximum figures ranging from 5% to 15%.

The minimum concentration of asphaltogenic acids which is found to be injurious is stated to be approximately 0·50%, depending on the nature of the foliage to be sprayed.

The interfacial tension between the acids and material saturated with water is much less than between the same material and unoxidized oil, and it is suggested that, in the first place, the acids pass more readily through the walls of the leaf cell, and then exert their toxic effect by further breakdown into colloidal asphaltic compounds, with probable absorption of the oxygen from the cell itself. F. E. A. T.

667.752.2

715. Nitrocellulose Lacquers. F. A. Bent and S. N. Wik. *Ind. Eng. Chem.*, 1936, **28**, 312.—A new rapid method for determining rates of evaporation of liquids has been developed, and has been found to give results which serve as a reliable guide in the formulation of lacquer thinners. This new method is compared with other methods prevailing in the lacquer industry. Rates of evaporation were determined for various classes of organic solvents and diluents used in the lacquer industry. As a result of the experiments conducted it has been shown that the rates of evaporation of the liquid components of a lacquer influence the final structure and appearance of the film. H. E. T.

665.547 : 608.3

716. Patents on Special Products. N.V. Bat. Petr. Mij. E.P. 443,679, 4.3.36. Manufacture of drying oils by treating highly unsaturated cracked products of considerable di-alkene content, at 70° C. with aluminium chloride and recovering the drying compounds from the reaction products.

J. Y. Johnson. E.P. 444,019, 9.3.36. Synthetic methanol is purified by washing the aqueous crude methanol containing 10–35% by volume of water, with a solvent which is barely miscible with the water and with the aqueous methanol, and has a higher solvent power for the impurities than for the methanol, e.g. *iso*butyrone.

J. Y. Johnson. E.P. 444,117, 16.3.36. Separation of propyl ether from a mixture of the same with propyl alcohol by distillation and maintaining the water content of the mixture so that the ether is driven over with the water as a constant-boiling minimum mixture. The distilled ether is withdrawn from the water separating in the receiver. This water is returned to the distillation vessel.

Soc. Franc. De Catalyse Gen. and A. H. Stevens. E.P. 444,186, 13.3.36. Production of olefine oxides and of a catalyst for use in the production of same. Silver or gold or both are used as catalysts, either as elements or alloyed with small quantities of another metal in the form of small fragments or flakes.

Deutsche Hydrierwerke A.G. E.P. 444,239, 16.3.36. Manufacture of compounds of high molecular weight of heteropolar constitution which are miscible with water in a colloidal manner or soluble in water. 6-Chlorohexanol (1) or 10-chlorodecanol (1) is condensed with alkaline sulphites to eliminate the halogen atom, and with sulphuric acid, chlorosulphonic acid or alkylene oxides to eliminate the hydrogen atom of the hydroxyl group.

N.V. Bat. Petr. Mij. E.P. 444,544, 23.3.36. Manufacture of organic peroxides, *e.g.* acetone peroxide. An aqueous solution of persulphuric acid or of a persulphate is hydrolysed, and then allowed to react in the presence of acid on acetone or its homologues.

Carbide and Carbon Chemicals Corpn. and T. F. Carruthers. E.P. 444,603, 24.3.36. Manufacture of acetyl benzoyl peroxide by passing air through a mixture of benzaldehyde and acetic anhydride (in molar excess) containing 0·66% of dibenzoyl peroxide at 35° C., and then separating the acetyl benzoyl peroxide from the mixture.

J. Y. Johnson. E.P. 444,689, 24.3.36. Manufacture and production of condensation products from acetylene and sulphuretted hydrogen by allowing acetylene to react with sulphuretted hydrogen in the presence of a liquid solvent and, if desired, a catalyst, *e.g.* potassium hydrosulphide. W. S. E. C.

Engines.

621.317.755

717. Cathode-Ray Oscillograph for Oil Engine Injection Research. Anon. *Engineer*, 1936, **161**, 456.—In this article is described an apparatus used by the makers of the E.H. oil-engine fuel-injection pump, to study injection systems. It was designed by Mr. W. R. Groves of E.H. Fuel Injection, Ltd., to the specification of Mr. A. F. Evans of the same company, and incorporates a cathode-ray tube in conjunction with a carbon pile-type pressure element.

The article compares the various electrical methods of indicating pressure changes, *i.e.* Electro-Magnetic, Piezo-electric crystal, the Light cell, and the Carbon Pile; and points out the advantages of the latter over the others for this particular type of work.

The apparatus consists of a carbon pile pressure element, using a steel diaphragm 0·04 in. thick and about thirty thin carbon discs, coupled to a cathode-ray tube through a single-stage amplifier, using one H.F. pentode directly coupled to the pile. It is claimed that the circuit used is extremely stable, and free from any reactive element such as a condenser or inductance, and its frequency characteristic is as nearly perfect as possible over the required range; and that static calibration of the unit is very simple, since direct coupling is employed. The time-base circuit for the cathode-ray tube is of the usual type, consisting of a condenser and a rotating contact on the pump shaft, with a constant-current device to ensure a linear rate of travel of the spot.

Differentiation of the diagrams obtained is carried out by means of a special transformer inserted between the carbon pile and the amplifier; but since any one transformer is suitable only for a certain range of frequencies, three small plug-in transformers are necessary to cover the range of frequencies met in an engineering shop. A time scale giving a horizontal line notched every 6 degrees of rotation is provided by a commutator and contact on the pump shaft.

Some delivery-pressure diagrams and their differentials taken from an E.H. pump with the indicator are shown; also a diagram showing the effect of throttle opening on delivery-pressure.

A unit for measuring the discharge from the pump is described, and diagrams obtained with it are shown; also curves of the discharge of the E.H. pump illustrating the close agreement between the theoretical and actual discharge. J. A. C.

621.317.755

718. Auxiliary Equipment for Cathode Ray Tubes. R. R. Batcher. *Instruments*, 1936, **9**, 77.—A description of time base circuits for cathode-ray tubes, including linear and logarithmic time bases, radio-frequency sweeps using pentodes or triodes in place of gas-filled discharge tubes and suitable circuits for use with deflection coils. P. D.

621.43.01

719. Combustion Phenomena in the Natural Gas Engine. Parts I and II. J. Liston. *Refiner*, 1936, **15**, 73, 110.—In the first article methods of calculating air–fuel ratios for natural gases and effects on performance of varying the air–fuel ratio are discussed, and it is observed that (1) although the heating value of the different natural gas hydrocarbons varies widely, the heat energy per cu. ft. of chemically correct air–fuel

mixture is nearly the same for all gases. (2) The power that an engine can theoretically develop is determined by the heat energy per cu. ft. of air–fuel mixture rather than by the heat energy per cu. ft. of fuel; hence, the power that a gas engine can develop will not vary greatly with natural gases of different composition, providing proper adjustment for air–fuel ratio is made. (3) Theoretically either an excess of air or fuel will decrease the power output and efficiency. In Part II, tests on a 35-H.P. two-stroke natural gas engine are described, power output being measured by a Prony brake, fuel by a gas meter and air by use of indicator cards on the scavenging or compressor end of the cylinder. By varying the position of the bell on top of the cylinder the volumetric efficiency could be varied over the entire range of air-fuel ratios at which the engine operates. The test data on a fuel containing 92·5% methane showed that the percentage of excess air and the heating value of the mixture closely parallel the theoretical values for methane. The oxygen was, for any given air-fuel ratio, much higher than it theoretically should be, due in part to incomplete mixing and subsequent incomplete combustion. It is indicated that the length of the exhaust pipe has an important bearing on the power output and efficiency. G. R. N.

621.438

720. Prime-movers for Indigenous Fuels. W. Hamilton Martin. *Gas & Oil Power*, Feb. 1936, **31** (365), 38.—The need for investigating every available means for acquiring further indigenous fuels and studying methods for transforming them into energy in the most efficient manner is urged. Reviewing the situation in Germany, it is pointed out that even after erection of all the proposed coal-carbonization and synthetic gasoline plants, only about 25% of total requirements will be obtained from indigenous fuels. The writer considers that this shortage is bound to lead to the commercial development of the coal-dust engine. Recently a multi-cylinder high-speed Rupa engine has made successful trials, and the development of such engines has received private and Governmental support. German coals and brown coals are not nearly so suitable for such engines as the low-ash coals available in England. The value of the coal-dust engine is urged on both national and economic grounds. R. A. E.

Coal and Shale.

662.74 : 608.3

721. Patents on Coal and Shale. A. A. MacCubbin and J. Zavertnik, Jr. U.S.P. 2,029,883, 4.2.36. Multi-stage distillation of coal-tar, low-temperature tar, water-gas tar, etc., using two stills. One stage is carried out under high vacuum, and the distillates from both stages of the process are collected separately. W. S. E. C.

Economics and Statistics.

622.323 : 622(438)

722. Polish Oil Industry in 1935. Anon. *Rev. Petr.*, 25.4.36 (680), 613–614.—The article opens by pointing out that before the War, Galicia could claim about 3·5% of the world's oil production, but to-day has no more than 0·23%. The principal reason for this is the continuous exhaustion of the Boryslaw field, which has produced 24 millions of tonnes out of the 34 millions of tonnes which has been extracted from Galicia to date. Boryslaw has shown an average of 16,067 tonnes/hectare, compared with 4742 tonnes/hectare from all the other Polish fields. Poland, one of the least motorized countries (1 automobile to every 1250 of inhabitants), consumes about 300,000 tonnes of oil a year (9·21 kg./head of population), roughly one-third of its production, but in a few years it may be expected that this figure will be largely increased, when the domestic demand will exceed the national production unless new fields are discovered. Hopes of increasing the production have been raised by promising results in Pasieczna, Lipia, etc., in the Carpathians, and other immense terrains in the frontier-country are awaiting exploration drilling. The drilling figures for 1935 are then detailed, and the following table of crude oil production is given :—

	1925.	1934.	1935.
District of Drohobycz :	Tonnes.	Tonnes.	Tonnes.
Boryslaw	622,860	301,380	285,980
Other wells . . .	74,500	97,530	94,290
District of Jaslo . . .	64,640	95,380	99,080
District of Stanislawow . .	49,800	34,910	35,410
Totals . . .	811,800	529,200	514,760

Boryslaw has declined in 10 years by 336,980 tonnes, or over 50%. The other fields have increased in 10 years by 39,840 tonnes, or about 21%. And the net decline in 10 years for the whole country is 297,140 tonnes, or over 36%. It is then shown that the production of natural gas has been maintained at about the same level for 10 years, but the production from Boryslaw has decreased by half from that of 1925. Gas takes a most important place in Polish industry, and the reserves of natural gas are believed to be such as to warrant the transportation and utilization of this gas in the most distant industrial regions of Poland. The production of gasoline has doubled in 10 years. A table is then given of the production of oil and gas in percentages for each of the big oil companies and for the other smaller producers taken together. The activities of the refineries are then reviewed, with a table of products. Then domestic consumption and prices realized are detailed, and finally the exportation of the petroleum products and the countries to which they are consigned are given.

In conclusion, the article stresses that the fall in oil production in Galicia cannot be arrested, even by intensified production methods from the old Boryslaw fields alone, and, if Poland is to take its proper place in the world's supplies, or, at least, in supplying its own domestic requirements, that it must direct all its efforts towards discovering new productive fields. At present there are only twelve prospecting wells in the Carpathians, and in the frontier country only five discovery wells are actually working. However, for the past 10 years exploration work has been carried out, and "la Societe Pionier" has collected a great amount of geophysical information about the frontier area which can be exploited only by very deep drilling based on the maximum available information. Exploration drilling conducted in a methodical manner has a very good chance of discovering new petroleum deposits the existence of which is very probable. B. F. N. M.

658.2 : 665.5 : 65(73)

723. Future U.S. Demand for Petroleum. S. St. Clair. *Min. & Met.*, 1936, **17**, 246.—The author combats the estimates given by the A.P.I. early in 1936. In four tables he bases his estimates on an increased domestic demand for each decade from 1940 to 1980, consequent on an estimated progressive increase of population during those decades. He believes the net crude requirements will rise from 1153 million brls. in 1940 to 1500 million brls. in 1980, and the population will increase from 127,800,000 in 1935 to 155,000,000 in 1960. The domestic demand in 1936 is expected to increase from 1,065,000,000 brls. to 1,243,000,000 brls. in 1940. B. F. N. M.

REVIEWS, BOOKS RECEIVED, AND NEW PERIODICALS.

Reviews.

553.578.2(02)

ERDÖL. K. Krejci-Graf. viii + 164 pp. Berlin, Verlag von Julius Springer, 1936. Rm. 4.80.

This little volume, though appearing as No. 28 of a series entitled "Popular Science" (Verständliche Wissenschaft), is in the main a most interesting exposition of the author's present views on the very debatable subject of the origin of oil. He commences with a brief introduction touching on the importance of oil and some historical references to it, and then deals with his subject under three headings:—

1. *The Occurrence of Oil.* This is briefly dealt with (pp. 5–17), giving the characteristics of oil-bearing rocks, the anticlinal theory and some typical oil-bearing structures; it forms an introduction to the main subject.

2. *The Origin of Oil and its Horizons.* This forms the important part of the book (pp. 17–147). The author first deals with the varied theories of origin, and passes on to discuss the geological conditions under which oil is found. Migration of oil is dealt with at some length, followed by a chapter on conditions of sedimentation, and this leads on to the interesting and much-argued subject of "source rocks." He stresses the independence of coal and oil formation and occurrences, pointing out that, in general, fresh-water deposits tend towards coal formation, nor does he admit any general connection between brackish-water deposition and oil formation.

In the same way, he discusses many marine deposits and their organic contents, discarding them as providing the source of oil.

It is to the marginal deposits of geosynclines that he assigns the rôle of oil-forming sediments: these are now represented by the "foreland" lying partly in front of and partly below the surface folds.

The geochemistry of the bitumens is discussed at considerable length, and the author's views are summed up on page 139 in a diagram showing the evolution of different oils and related substances from the raw materials.

3. *The Search for and Exploitation of Oil.* This is very briefly dealt with on pp. 148–159, one feels rather by way of rounding off the work than as a very serious contribution to the subject.

This publication, which is extremely well printed and contains several well-chosen illustrations, forms a valuable addition to discussions on the origin of oil and its present distribution.

JAMES ROMANES.

66.094.56(02)

NEUERE SULFONIERUNGSVERFAHREN ZUR HERSTELLUNG VON DISPERGIER-NETZ- UND WASCHMITTELN. Dr. A. van der Werth and Dr. F. Müller. 2nd Edition. Pp. 127. Berlin, Allgemeiner Industrie-Verlag G.m.b.H., 1935. Rm. 9.60.

A second edition of this compilation on Processes of Sulphonation for the preparation of dispersing, wetting and washing agents having been called for within three years of its original publication indicates clearly the importance which has been attached to it by the industrial circles interested. The book is a carefully chosen collection of summaries of the principal patents of the world. In this new edition a further fifty or so patents have been included, the total number up to 1934–5 being around 800.

The scope of the book covers:—

1. Sulphonation of mineral oils and their derivatives.

2. Sulphonation of aromatic compounds, sub-divided into alkylated, fatty and condensed aromatic sulphonic acids.

3. Sulphonation of fatty acids from esters and derivatives. This, of course, is the biggest section of the book, and is sub-divided into eight sections dealing with fatty acids and their esters; higher alcohols and their derivatives such as ketones, aldehydes, etc.; paraffins and their derivatives; condensation products; and the general methods of preparation and purification of the sulphonic acids.

The volume will continue to prove of the greatest use to those working in this field.

S. J. M. AULD.

621.899(02)

ZUR FRAGE DER VERÄNDERUNG VON SCHMIERÖLEN IM GEBRAUCH UND IHRER REGENERIERUNG. Dr.-Ing. H. Kamptner. Pp. 24. Wien, Verlag für Fachliteratur G.m.b.H., 1935.

This is an interesting little pamphlet prepared by Dr. Kamptner on behalf of the Austrian Petroleum Institute, the practical work having been done in the Chemical Technological Institute of the Technical High School, Vienna. It is mostly given over to a *résumé* of the literature dealing with the recovery of motor oils, and indicates that considerable divergence of opinion exists amongst patentees and investigators. The practical work referred to deals with two experimental oils, one an unmixed fraction from a naphthenic-base crude oil, the second being the No. 1 oil with the addition of 10% of Bright Stock. These oils were used on the road for 3000 to 4000 kilometres, and then refined partly by simple filtration and partly by complete regeneration with acid.

As an oversight on the literature of the subject the brochure has much to commend it.

S. J. M. AULD.

Books Received.

543 : 665.521.2

THE DETERMINATION OF AROMATIC COMPOUNDS IN COMMERCIAL LOW-BOILING PETROLEUM DISTILLATES by the Austrian Petroleum Institute, edited by F. Lang, 33 pages, Published by the Verlag für Fachliteratur G.m.b.H. Vienna XIX, Vegagasse 4.

This booklet, which is in German, should prove of value to petroleum technologists, particularly to those interested in the analysis of motor fuels. After a critical review of previously proposed methods for estimating the aromatic and unsaturated compounds in low-boiling petroleum distillates, details are given of tests carried out by those methods which appeared the most suitable. A method involving nitration is finally recommended, any unsaturated hydrocarbons having previously been removed with 85% sulphuric acid. Full experimental details are given and tables of results showing the application of the method to "synthetic" mixtures as well as to actual samples of petroleum distillates.

31(71) : 662.75

CANADA DEPARTMENT OF MINES, Bull. 772. PETROLEUM FUELS IN CANADA, 1934. John M. Casey. 20 pp. 1936, Dept. of Mines, Ottawa. 10 cents.

Statistical information is given regarding the quantities of fuel oil, kerosine, gasoline and petroleum coke delivered for consumption as fuel in Canada. The deliveries in 1934, in millions of Imperial gallons, were :—Fuel oil, 479; Kerosine, 36; Gasoline, 535; and Coke 56,400 short tons.

665.54

SCHWARZ, R. DIE ERDÖLRAFFINERIEN DER WELT. 38 pp. 1936, Verlag für Fachliteratur G.m.b.H., Vienna and Berlin. 6s.; $1.50.

This comprises a detailed list of the world's petroleum refineries, arranged under countries. In most cases information is given regarding the capacity, location and ownership. Statistical data of refinery output and the consumption of chemicals are included, together with a table of petroleum nomenclature in twenty-one languages. The last sixteen pages are devoted to a directory of firms on the Continent who supply equipment for use in the petroleum industry.

665.5 : 65(44)

GUIDE DU PETROLE, Son Industrie, Son Commerce, Leurs Fournisseurs. Olivier Lesourd. 3bis, Rue Roussel, Paris (XVII^e). 750 pp. 65 frs.

This Directory of the French petroleum industry, to which Colonel L. Pineau has contributed a Preface, contains a mass of important facts and statistics. It is indispensable as a book of reference to all who are in any way connected with the petroleum industry of France.

Additional information has been added to the 1936 edition dealing with the testing of petroleum, density conversion tables, and a directory of French petroleum technologists.

665.521.4 : 06(44)

GUIDE DES HUILES LOURDES, 1935–1936. Editor Olivier Lesourd, 3bis, Rue Roussel, Paris (XVII^e). 291 pp. 30 frs.

This volume contains technical data on fuel oils and diesel oils, fuel-oil business and industrial heating installations; also a directory of diesel-engine manufacturers in France.

697(02)

DESIGN PROBLEMS OF HEATING AND VENTILATION. A. T. Henly. 382 pp. 145 illus. London, Crosby Lockwood & Son, Ltd., 1936. 42*s*.

Written primarily for the architect and heating engineer, this book contains valuable data and formulæ applicable to analogous problems of design met with in refinery engineering.

The scope of the book is very wide. It deals exhaustively with theoretical principles underlying the design of heating and ventilating systems, and discusses many examples of their application in recent buildings in England and Europe. Nomographic methods are extensively employed for the calculation of temperature fall and heat losses. The section dealing with steam distribution and boiler plants contains a very complete treatment of thermal storage systems. Ventilation and industrial air conditioning are considered in relation to the problems of specific industries.

62(02)

BACON'S COMMERCIAL ENGINEERING. James Bacon. 288 pp. London, Crosby Lockwood & Sons, Ltd., 1934. 6*s*.

This is an extremely valuable little book, dealing with questions arising in the day-to-day routine of an engineer's office, which are rarely treated in a separate publication. The scope of the book partly coincides with Section C of the Associate Membership examination of the Institution of Mechanical Engineers. Among the subjects dealt with are Estimating, Tendering, Plans and Specifications, Sales Organization and Advertising. Two very interesting chapters deal with "The Engineering Affairs of Public Authorities" and "Sources of Engineering Information," respectively.

The second part of the book is devoted to an outline of practical economic considerations of Trade and Markets, Taxation, Insurance and Joint Stock Company organization. The treatment is essentially practical, and no attempt is made to delve into the theories of economists. The book is intended mainly to assist the young engineer towards an understanding of commercial matters with which he is immediately brought into contact on entering an engineer's office.

New Periodical.

55.03(05)(73)

GEOPHYSICS. A Journal of General and Applied Geophysics; published by The Society of Petroleum Geophysicists 2011 Esperson Building, Houston, Texas, U.S.A. Price to non-members: $3.00 per annum, plus postage. To be published bi-annually. Vol. I, Pt. I, published January 1936. Pp. 1–178.

The Society of Petroleum Geophysicists was organized in 1930 at Houston, Texas. In 1932 the Society was affiliated with the American Association of Petroleum Geologists, and was chartered as the Division of Geophysics, A.A.P.G.

With the exception of a separate publication in July 1935, all contributions to the Division of Geophysics have been published in the monthly *Bulletin of the American Association of Petroleum Geologists*. The geophysical papers will in future be published in *Geophysics*, appearing bi-annually.

The first issue of this publication contains eleven technical Papers, together with Reports on Regional Geophysical activity during 1935. Abstracts of the papers of more general interest have already appeared in the present volume of the *Journal* (*vide* Abstracts Nos. 488, 490, 493).

ABSTRACTS.

	PAGE
Geology	280 A
Geophysics	286 A
Drilling	288 A
Production	292 A
Transport	294 A
Gas	295 A
Crude Oil	297 A
Chemistry and Physics	297 A
Analysis and Testing	300 A
Refining and Refinery Plant ...	302 A
Cracking	303 A
Hydrogenation	304 A
Polymerization	305 A
Motor Fuels	307 A
Kerosine	314 A
Lubricants and Lubrication ...	314 A
Fuel Oil	319 A
Asphalt and Bitumen	320 A
Special Products	321 A
Engines	323 A
Coal	325 A
Economics and Statistics ...	325 A
Reviews, Books Received, and New Periodicals	326 A

AUTHOR INDEX.

The numbers refer to the Abstract Number.

Aldridge, B. G., 827
Aleksandrov, L. A., 800
Andrau, E. W. K., 737
Andrews, C. W., 801
Armstrong, R. T., 777, 778
Arnold, C., 817, 827
Ashdown, A. A., 777, 778
Atlantic Refining Co., 827

Baichikov, A. G., 834
Barton, C. H., 826
Batoufobe Petroleum Mf., 817, 827
Beecher, R. B., 842
Bateman, W. H., 767
Batten, W. E., 769
Behnke, G. E., 756
Bellin, A. E., 836
Bignell, L. G. E., 759
Billkin, V., 726
Bleeb, S. F., 807
Block, H. C., 756
Bray, U. B., 827
Brashnikov, V. T., 771
Breese, J. J., 829
Brownscombe, H. W., 821
Bruun, J. H., 774

Campbell, J. A., 795
Carbide & Carbon Chemicals Corporation, 839
Catland, A. C., 756
Cavins, O. A., 756
Child, W. C., 831
Clark, A. M., 769
Clark, R. P., 739
Clough, K. H., 739
Codier, C., 817
Cole, H. A., 790
Collins, J. O., 831
Corwin, W. S., 730
Craig, H. J., 756

Davis, G. H. B., 817
Davis, R. A., 756
Dean, D. K., 799
Deussen, A., 737
Deutsche Gasolin A. G., 827
Doboryanski, A. F., 791
Duckham, A., 827
Duffing, G., 822
Du Pont de Nemour, E. I., & Co., 802, 839
D'Yarmett, E. C., 799, 801
Dyer, W. S., 764

Eaton, J. F., 760
Egloff, G., 812, 817
Erdheim, E., 796, 797

Faulkner, F. L., 825
Fenner, C. N., 734
Fletcher, H. W., 756
Flood, T. B., 743
Finde, J. W., 742
Foote, P. D., 740
Foster, A. L., 803, 809
Free, G., 783
Freure, B. T., 839
Fuidge, G. H., 833
Fuestieg, R., 766

Ganitski, I., 845
Gary, W. W., 817
Gates, L. G., 756
Geniesse, J. C., 817
Gifford, H. W. P., 817, 847
Gleason, G. W., 766
Govers, F. X., 827
Greenfield, E. W., 787
Griffith, R. H., 783
Grosholz, R., 795
Gross, H. H., 827
Groves, W. W., 839
Guinmann, T. A., 806
Gurwich, G. R., 836
Gusman, D., 826
Gyro Process Company, 801

Haines, M. W., 756
Halbouty, M. T., 735
Hampton, A. C., 801
Harris, F., 778
Harris, L., 777
Harrison, C. P. R., 769
Haslam, R. T., 803
Heisig, G. B., 783
Hennion, G. F., 776
Herbert, W. F., 761
Hernek, H. N., 756
Hicks-Bruun, M. M., 774
Hill, J. B., 801
Hill, S. G., 792
Holmes, A., 831
Hoover, C. O., 817
Hopper, B., 827
Horner, W. L., 728
Howard, J. H., 756
Huff, L. C., 801

I.G. Farbenindustrie A.-G., 839
Ibrig, H. K., 763
Imperial Chemical Industries, Ltd., 769, 839
International Hydrogenation Patents Company, 802
Ipatieff, V. N., 769, 805

Jakosky, J. J., 756
Johnson, J. Y., 769, 802, 806, 839
Johnson, W., 810
Jones, A., 839
Jones, L. D., 827

Kallos, K., 751
Katz, K., 770
Kent, A. T., 769
Keyte, W. R., 725
Kistiakowsky, G. B., 779
Klemgard, E. N., 824
Kordiuk, B., 735
Kostrin, K. V., 820
Kothay, G. L., 750
Kuentzel, W. B., 806
Kwal, B., 803
Kyurkchan, A., 826

Langton, A., 754
Larson, L., 810
Layne, L. A., 756
Leenderts, J. J., 775
Leib, C. H., 798
Levkopulo, N., 813
Levorsen, A. I., 732
Likhushin, K., 818
Lindsly, B. E., 757
Lobkov, A. M., 763
Luckenrath, H., 746

Mass, W., 823
Macelwane, J. B., 745
Macready, G. A., 756
Makkink, J. P., 775
Malamphy, M. C., 743
Malishev, B. W., 798
Malisoff, W. M., 827
Maliyants, A. A., 773
Manley, R. E., 827
Marsene Corpn. of America, 769
Maxwell, W. H., 756
McKee, R. H., 769, 784
McMillan, W. A., 790
Miller, M. B., & Co., 827
Miller, S. P., 847
Miller, W., 817
Mitford, W. B., 801
Monakhova, V., 835
Morgan, J. D., 830
Morrell, J. C., 806, 812, 817, 839
Moss, C. O., 756
Mummert, J. F., 756

Naphtali, M., 819
Nelson, W. L., 794
Nieuwe Ostroce Mij., N.V., 801
Nieuwland, J. A., 776

Ofenbau Gesellschaft, 830
Otis, H. C., 756
Owen, W. H., 769

Patterson, E. W., 756
Paul, J., 756
Paul, W. H., 766
Paulus, M. G., 799
Peterkin, A. G., 801
Petersen, R. S., 801
Pfirrmann, T. W., 803
Pfund, A. H., 787
Pines, H., 805
Popov, S. N., 836
Postlewaite, W. R., 756
Potts, H. E., 803

Raikhlin, Y. B., 792, 793
Reis, A., 817
Rembert, E. W., 801
Reuter, R., 817
Ridley, R. M., 756
Ritchie, A. V., 790
Roeder, C. H., 840
Rubichon, A., 735
Ruhrchemie A.-G., 817

Sage, C. R., 789
Sato, M., 802
Sawdon, W. A., 749
Scherger, T. A., 843
Schnaebele, R., 727
Schneringer, F. N., 756
Schulze, G. A., 744
Schwers, F., 814
Sclater, K. O., 755
Scott, R. C., 753
Seguy, J. D., 801
Seto, I., 802
Sharples Specialty Company, 827
Shenfinkel, I. K., 837
Sherrill, M. L., 780, 781
Shkhiyan, S., 818
Shmuk, A. A., 833
Sieder, E. N., 799
Singleton, J. C., 756
Skoblo, A., 826
Smith, F. E., 813
Smith, H. W., 786
Smith, W. R., 779
Sparrow, S. W., 843
Spencer, L., 756
Standard Alcohol Co., 839
Standard Oil Development Company, 769, 817, 827
Stansfield, R., 807, 841
Steele, J., 840
Stevens, A. H., 827
Stevens, S. G. B., 789
Still, A. C., 801
Stevens, J. L., 801
Swift, O. E., 827
Taylor, T. I., 810
Teichmuller, R., 733
Texaco Development Corporation, 827
Thompson, A. E., 799
Thompson, D. D., 780
Thorn, S. D., 776
Thornycroft, C., 846
Tikhinov-Dubrovski, N. T., 791
Tikhomirova, M. M., 835
Tiraspolsky, W., 731
Trask, P. D., 725
Triggs, W. W., 769
Turkington, W., 756
Turner, E. B., 747
Uhde, F., 802
Varshavskii, S. L., 837
Walch, H., 827
Walter, G. F., 781
Walton, J. S., 811
Waterman, H. I., 775
Wells, W. I., 756
Wharton, A., 840
Wickersham, H. P., 756
Wickert, J. W., 839
Wiggins, W. R., 773
Wilhelm, R. H., 784
Williams, N., 741, 789
Winter, R. A., 769
Withers, J. S., 827
Woodall-Duckham Ltd., 769
Wright, J. C., 756
Youker, M. P., 769
Zarkhin, A. M., 792, 793

Geology.

551.23

724. Bore-hole Investigations in Yellowstone Park. C. N. Fenner. *J. Geol.*, 1936, **44**, 225–315.—Material for the study of thermal phenomena of the geysers was obtained by the Geophysical Laboratory from the cores supplied from two bore-holes drilled in the geyser basins: During drilling, temperatures and pressures were measured, and later the cores were examined in the laboratory by chemical and petrological methods to determine the significance of any mineral transformation caused by hydrothermal circulation.

Explanation of underground circulation was indicated by the study of such structural features as porosity and fractures in conjunction with thermal changes. When surface waters from the plateau areas eventually reach deep levels by downward percolation and meet the magmatic ebullitions, they are diverted upwards, and emerge at the surface as hot springs and geysers; but the mechanism of geyser action is shown by this study of the phenomena to be more complicated than had been supposed. Important metasomatic alteration of rocks has taken place, a variety of new minerals has been formed and the composition has been changed. The cores particularly indicate the addition of silica and the molar replacement of the soda and lime of the feldspars by potash. A final marshalling of all the harmonious evidence has led to a confident elaboration of a series of reactions; which apply not only to the rocks accessible by the two bore-holes, but also to those of greater depth. From this series can be evolved the manner whereby the original magmatic effusions, dissolved in the meteoric waters, not only have changed the composition of the rocks through which they passed, but have also themselves been altered. B. F. N. M.

552.578.2

725. Degree of Reduction in the East Texas Basin as an Index of Source Beds. P. D. Trask and W. R. Keyte. *Oil & Gas J.*, 21.5.36, **35** (1), 84–89.—The basis of this research is the high hydrogen and low oxygen content of petroleum compounds, and it is considered that the materials responsible for their generation will be rich in substances of relatively low oxygen content. Although it is recognized that there are probably a number of cases where the oil has migrated a considerable distance from the source rock, it is assumed that sediments associated with, or comparatively near to, oil-producing horizons have probably generated the oil.

The degree of reduction is calculated on the nitrogen content and expressed in terms of the deviation from the average, which is given as 6·0. The report is based on 3300 samples from about 50 wells in the East Texas region, some being taken from the basin and representing the Austin Chalk, the Eagle Ford Shale, the Woodbine Sand and the upper part of the Washita Group. The remainder come from the East Texas field, and range from Eocene to Lower Cretaceous. The organic content of these sediments varies between 1·5% and 4·0%, the Eagle Ford Shale being the richest.

The average nitrogen-reduction ratio for each formation was determined, and when the figures representing individual samples were plotted on maps, lines were drawn to separate areas in which the ratio was higher than the average. It is concluded that a low nitrogen-reduction ratio is a favourable indication of source beds and vice versa. In the East Texas basin the results indicate that the Wilcox is unfavourable. The Midway, Navarro, Taylor, Austin, and Eagle Ford are favourable. The Woodbine and Washita are only slightly favourable or almost neutral.

Further work is being done on other petroliferous areas. J. A. G.

553.982

726. **Methods of Estimating Underground Reserves.** V. Bilikin. *Oil Weekly*, 27.4.36, **81** (7), 33; 1.6.36, **81** (12), 26; 15.6.36, **82** (1), 48.—This paper outlines methods of calculating or estimating oil reserves, which have been approved by the Organization Committee of the 17th International Geological Congress to be held in Moscow in 1937, and are the methods to be employed by those desiring to submit papers on reserves of nations of the world.

The first part consists of the methods of marking areas for calculations, of categories of reserves and their relations to the groups of areas, and methods of estimation used for individual categories of reserves. The second part of estimates of oil reserves by curves and formulæ for working out the estimates.

The third part is the conclusion, which consists of the statements:

(1) That the underground reserves of economical importance are those obtainable by wells from each horizon by the modern method of exploitation.

(2) That the reserves estimated by the method given do not include any oil which can be obtained by secondary methods of exploitation as well as mining.

(3) That there are no sufficient data on how the efficiency can be increased by using the methods here discussed.

(4) That it is impossible to find out with sufficient accuracy to which horizons the secondary methods can be better applied.

(5) The data on the percentage of oil obtained by means of mining are contradictory.

(6) That if it is necessary to estimate the reserves which can be obtained by use of secondary methods, the percentage of the mistakes of efficiency already accepted must be determined to establish the amount of recoverable oil. B. F. N. M.

553.982

727. **Estimation of Oil Reserves at Pechelbronn.** R. Schnaebele. *Petr. Z.*, 1.4.36, **32** (14), 4–5.—A method is given of estimating the oil reserves of a deposit to be mined, this method being based on figures of production obtained during past years. The formula used is, $G = B/D(C_0D_0 - D + D_0)$, where: G is the amount to be obtained by mining; B is the amount obtained from wells on the area; D is the number of wells per unit area; D_0 is the number of wells per unit area under ideal conditions of working; C_0 is the coefficient of drainage, also under ideal conditions.

It is shown that $C_0 = D(G + B)/BD_0 - 1$.

Two conditions arise. When the wells show the deposit to be of similar type to those already mined (similar in porosity, permeability, structure, etc.), then $D_0 = 1$ and $C_0 = 1{\cdot}7$. When, however, the new field is different in type, D_0 must be obtained by gradually increasing the number of wells in unit area until ideal conditions are obtained. In such a case C_0 cannot be determined very closely. S. E. C.

553.982

728. **Core Analyses.** W. L. Horner. *Oil Weekly*, 1.6.36, **18** (12), 31–36.—The essential physical factors influencing the productibility of a formation at any given pressure differential are the size and number of pores and the nature of the fluid contents. Core analyses give a direct method of obtaining accurate knowledge of these factors. The necessary precautions to secure the best cores and the methods of their adoption are then explained. Permeability is then defined. A darcy is its arbitrary unit, and the process of arriving at the permeability in millidarcys of any core surface is set out. Before defining porosity it is pointed out that porosity is not a satisfactory index to

permeability, a table being given showing variations in these two physical properties in 16 samples from oil sands, demonstrating the independence between porosity and permeability. The pores of all reservoir rocks are found to be filled with gas, oil, water or a combination of the three. Three methods are given of estimating the oil content of a sand. The advantages of the enclosed-retort system over the other two are enumerated. Finally it is claimed that core analyses properly interpreted control the completion of a well so that the optimum production characteristics are revealed. Core analysis data for flush-well completion have determined: 1. The type of fluid to be expected. 2. The exact contacts of gas, oil and water. 3. The productivity. 4. The potentialities of each layer of sand 1 inch thick or thicker. 5. A permanent record of the formation, otherwise unobtainable. A core graph useful in future operations. In the future, improvements in technique should permit of every well being cored, but even the present field and laboratory methods are indispensable to modern operations and well completion. Results of analyses are produced within a few hours. Prior to 1931 permeability of rocks was confused with porosity by those who wanted only relative values. For the study of ultimate yield and spacing of wells, the physical facts on reservoir rocks, such as oil saturation, indigenous water saturation and vertical permeability, are essential.

Since methods for the determination of these data with rapid service are now available, it is expected that many of the present methods for estimating yields will be revised and less guesswork on sand conditions will prevail. B. F. N. M.

553.982

729. Evaluation of Oil-Bearing Cores. K. H. Clough. *Oil Weekly*, 15.6.36, 82 (1), 67.—Modern progress in the oil industry has enabled the geophycist to point out potential producing structures, the palæontologist and the geologist together to correlate the strata and contour the structure, the chemist to analyse what are now thoroughly representative cores and to furnish information of the predominant compounds present and of the percentage of sodium chloride contained; but all this advanced knowledge had not yet permitted an accurate forecast either of the production from a well or of the approximate reserves of an area. The elaboration of the bottom-hole bomb, the bottom-hole sampler, porosity and permeability equipment and well-surveying apparatus has given just such complementary aid to the results obtained by the first-mentioned scientific workers as to enable the production engineer to arrive at a close approximation of what was lacking in the forecast of an oil-field's future prospects. The determinations of the porosity of the core, the degree of saturation with oil, the sodium chloride percentage, and the sand grain-size relation may all be made by some such apparatus as is described in the paper and shown in a figure. The apparatus and process determine the pore space, the total volume of core and the salt content; but the permeability of the core, both horizontally and vertically, is excluded from the functions of the apparatus. (A description of the methods for determining permeability is given in W. S. Corwin's paper.—Abs. No. 730.) B. F. N. M.

553.982

730. Permeability of Sands in Relation to Increased Recovery. W. S. Corwin. *Oil Weekly*, 15.6.36, 82 (1), 58.—The rising demand for petroleum products shown this year prompts this discussion of the methods of increasing crude production to meet the demand which can be effected primarily by the discovery of new fields, and secondarily by greater operation efficiency and improved methods. Air and gas repressuring has accomplished much secondary recovery. Vital to secondary recovery is the accurate knowledge of the thickness and uniformity of the sand and of where initial production indicated high saturation, which, being determined, leads to the consideration of the permeability of the reservoir rock, the definition and description of which are the subject of this paper. Permeability is governed by the size and shape of the grain and type of cementing material. Rounded grains allow a greater flow than angular grains. The relationship of porosity to permeability is one of quality. A solid is permeable by the efficacy of porosity; a non-porous solid would be impermeable, but solids of the same porosity can be impermeable, slightly permeable or highly permeable. Water-flooding, having obtained greater recovery in

certain areas than was effected by air and gas, led to a scientific study of this method, and now many laboratories throughout the oil-fields prepare core samples for permeability, porosity and saturation tests, and issue reports to help the producer in repressuring his property. The results of several actual laboratory tests are given contrasting the porosities, saturations and permeabilities, and the divergent behaviour of the wells, from which the cores were taken, under water-flooding operations. A graph showing the porosity, saturation and permeability of a Bradford well illustrates one of the examples given.

Finally, the author recommends that operators take cores to ensure an established record of their territory structure. Laboratory procedure should be prompt and accurate, and all details of the core analysis should be available before shooting and completing a well. B. F. N. M.

553.982

731. Are We Going Towards the Era of Stratigraphical Reservoirs? W. Tiraspolsky. *Rev. Petr.*, 27.6.36 (689), 945.—For 30 years a series of alternating pessimistic and optimistic waves have disturbed scientific thought on the question of the discovery and supply of new oil reserves. Every period of gloom was succeeded by some effort of human genius which either by improving drilling and prospecting methods or by employing new views of search and exploitation tipped the scale in the opposite direction. The most optimistic prophecies have been surpassed by the realities up to the present. The author then gives a table of the opinions as to the reserves in 1908, 1914, 1915, 1918, 1921 and 1929 of David T. Day, R. Arnold, U.S. Bureau of Mines and the Amer. Assoc. Petr. Geol. in various of these years and of the actual production obtained to the end of 1934. Up to the last few years new oil-fields have rarely been discovered except by pure chance, because the old methods of exploration were not scientifically equipped with means of determining accurately underground structure and conditions. Only Arkansas, New Mexico and Montana were added to the producing States of the Union in 25 years. Then in the last few years Geophysics opened up a new field for prospectors by discovering oil horizons at depths thought to be buried for ever by the thickness of the overlying rocks. The world reserves yet to be discovered are certainly very important, but there seems to be considerable anxiety among American geologists as to the U.S. supremacy in the oil industry being definitely on the wane. The perfectibility of technical methods does not seem illimitable, curbed as it is by economic considerations. American prospectors still hold to the old postulates (the actual basis of all oil finding), and do not perceive that these postulates have only a restricted value, in that they are only particular cases of a general classification of possible oil pools. The classic picture of the ideal petroleum reservoir is a porous dome covered by an impermeable roof. In certain regions the core of such a dome is salt. It is tacitly held that oil finding is a tectonic problem. Structures are what are sought. According to A. I. Levorsen in nine out of twenty great American oil-fields, the principal factor which governed the catchment of oil was not the tectonic configuration of the rocks, but a petrographical discontinuity. The porous zone was laterally limited by a non-porous zone—that is to say, a characteristic stratigraphical discontinuity. Perhaps these nine fields may have been discovered by chance, perhaps by interference between the tectonic and stratigraphical indications, but it is believed that one half of the American oil-fields as yet undiscovered can be of this type. The hypothesis is tempting. American geologists will soon direct the search into this path. The technical difficulties which the pioneers will have to surmount to reveal this type of reservoir are great, but, if they succeed, it will be a brilliant proof of the danger which the simple ideas and the customary methods present. These ideas are undeniably valuable, but their apparent harmony results in enticement to sterilization of even the well-informed minds. B. F. N. M.

553.982

732. Stratigraphic versus Structural Accumulation. A. I. Levorsen. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 521–530.—In the search for new production, local deformations have always been sought. There is at present a danger that with the increasing number of new methods of attack the possibilities of finding such structures will soon be exhausted. Too little attention has been paid to the question of stratigraphic

traps, and it is to such that we must turn for future production. It is to be noted that of the 22 largest pools in the U.S.A., more than half of the production was obtained from pools of this type, although discovery was primarily due to local structures within them.

There are three conditions which deserve close attention and which offer great possibilities. These are: (1) flank sands on known domes and anticlines; (2) conditions below regional unconformities; (3) up-dip, wedge-shaped porosity.

Examples of these conditions are given and possible new areas in each case indicated. S. E. C.

553.982 : 553(43)

733. Possibility of Oil Production in Bavaria. R. Teichmuller and B. Kordiuk. *Oel u. Kohle*, 1936, **12**, 414–419.—The sedimentary rocks of S. Bavaria were studied as to their significance as mother- or reservoir-rocks for petroleum. The methods of examining favourable structures in the individual tectonic zones are given. It is concluded that, first, the Unterinn-Viertel and Tegernsee districts, and, secondly, the sub-alpine folds deserve special geological and geophysical study. P. G. H.

553.982 : 553(47)

734. Russia's Second Petroleum Basis. Anon. *Petr. Times*, 1936, **35**, 693.—Russia's crude oil production programme for 1936 provides for a total of 28,400,000 tonnes, of which 80% is assigned to Baku, about 15% to the Grosny district and the balance to other districts, of which a new one the Ural Emba area may be the most important. This vast territory is bounded N. by the Saratov–Uralsk–Orenburg Railway, E. by the Ural Mountains, S.E. by the Caspian Sea and W. by the River Volga. It has been explored geologically with the assistance of the latest geophysical methods. The geological conditions differ greatly from those in the Caucasus. The petroleum deposits are associated with salt domes, either on top of the domes or around their margins, the salt structures being comparable to those of the Mexican Gulf Coast of the U.S.A. More than 260 salt domes have already been definitely determined and about 1200 domes have been counted. Professor Gubkin estimates that this type of dome should be a reservoir containing about 5,000,000 tonnes of oil. If 20% of the domes should be of that type, the territory's reserves would amount to nearly 1250 million tonnes.

The object of opening up this immense territory as a second petroleum basis is not so much to implement Russia's programme of increased crude petroleum production, as to relieve the Caucasus from the expected demand from Eastern Russia for oil necessary to the projected industrial activity of a region at such a great distance from the Caucasus. B. F. N. M.

553.982 : 553(498)

735. Petroleum Deposits of the Buzau District. A. Rubichon. *Mon. Petr. Roum.*, 1936, **11**, 823–832.—This is a geological discussion of the prospects of striking oil in commercial quantities in the Meotic beds of the Buzau district to take the place of, or form a reserve against, the feared exhaustion of the Dacian and Meotic beds of Prahova and Dambovita. The author approaches his subject as a "geologist of judicious optimism." After briefly giving his theory of the genesis of petroleum and of its distribution in the section of the great Carpathian arc, he states that stratigraphical evidence tends to prove the existence, in Tertiary times, of lagoons and gulfs on the outside edge of the Carpathians, since the Miocene Sea formed the Gulf of Slanic, stretching up to the foot of those mountains. The areas examined are then described in detail with the aid of a map and eight plates with sections, and the author sums up his description by stating that "In the sub-Carpathian Meotic at great depth oil in great quantity and under pressure will be recovered or nothing at all." The conclusions are that the Buzau district contains numerous neogene petroliferous zones. Eight areas ranging in extent from 300 to 5850 hectares, totalling 17,450 hectares, or about 68 square miles are exploitable, but if it is disputed that petroliferous beds can be suspected to exist as far as the edges of the Campa Romana, there would still remain 7600 hectares, or about 29 square miles, of good petroliferous

territory. Excessively prudent geologists who would hinder the exploration of the Rumanian plain would be doing great damage to the petroleum industry.

B. F. N. M.

553.982 : 553(536.5)

736. Two Bahrein Wells Yield above 20,000 Barrels. *Oil Weekly*, 8.6.36, **81** (13), 48.—The structure of Bahrein is an elongated dome with the major axis running N. 5° W. The crest is broad and flat. Oil and gas are obtained from a fractured limestone, with some calcareous sand and marl. A mixed base crude, ranging in gravity from 30·6° to 34·6° Bé., is produced from depths of 1850–2500 ft. The total productive area is undefined, but to June 1934, 10,000 acres had been proven.

The discovery well, 12 mls. south of Manama, the capital of the island, had an initial production of 500 brl. of 33·8° Bé. oil. The most recent completion is well No. 31, yielding 26,880 brl./day, whilst the initial production of No. 29 was 20,400 brl./day. There are now 26 producing wells on the island. G. D. H.

553.982 : 553(764)

737. Orange, Texas, Oil-field. A. Deussen and E. W. K. Andrau. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 531–559.—The Orange field, 6 miles W. of Orange on the Cow Bayou, lies above a deep-seated salt dome which has not yet been reached. There are no surface features, with the exception of gas seepages and "paraffin dirt." The peak of the development was in the boom years of 1921–22, and subsurface data is therefore scanty. Only one reliable marker bed can be recognized, the first main group of oil sands in the Miocene. This group usually consists of five oil sands in a 300-ft. series of sands and shales. An important unconformity exists in the central part of the field. The Heterostegina formation rests directly on the Vicksburg, with most of the Marginula formation and the whole of the Frio—a total of 2000 ft.—missing. It therefore appears that the uplift was active during Marginula–Frio times. The Miocene beds are block-faulted. A torsion balance survey showed that the dome may extend considerably beyond the present producing area, and that the sides of the salt have only a very gentle inclination. This is particularly the case on the north.

In addition to maps and sections, a list of all the wells drilled is given.

S. E. C.

553.982 : 553(764)

738. Geology and Geophysics showing Cap-rock and Salt Overhang of High Island Dome, Galveston County, Texas. M. T. Halbouty. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 560–611.—The High Island dome is indicated at the surface by a low mound rising out of the coastal marshes. The surface strata are the Beaumont clays (Pleistocene). The first producing well was drilled in 1922, production being from the cap-rock. The first production from below the overhang was obtained in 1931 and production from the field rose from 272,700 brl. in 1931 to 1,507,926 brl. in 1932.

Production is obtained from the cap-rock, the Pliocene, the Miocene, the *M Dv* zone, the Discorbis zone, and the Marginula zone. The *M Dv* zone is the most prolific. This zone marks a period of transition between the Discorbis zone and the Miocene.

The true cap-rock is a series of anhydrite, gypsum and calcite varying in thickness from 75 to 675 ft. Above this is the false cap-rock consisting of 200–1300 ft. of indurated, well-cemented, calcareous sandstone. This false cap is almost or entirely absent on the extreme flanks of the dome. The overhang is not confined to the salt, for the cap-rock extends beyond the salt to form a separate overhang, and production is as prolific under one as under the other. Overhang has been found from the N.W. to the S.E., with a horizontal extent of 250–800 ft. A seismic survey was carried out on the N.W. and S. flanks to determine the amount of this overhang.

Faulting of major importance has been detected on the south flank. A graben occurring there seems to coincide with a topographical depression on the surface. The data obtained by wells seem to point also to a peripheral fault extending from the N.W. flank around to the S.W. flank. The dome is elongated in a N.–S. direction, and the top of the salt on the S. and S.E. sides is 1500 ft. higher than on the N.W. side.

The paper is illustrated by 20 sections showing the overhang in the salt and cap-rock as well as by maps and geophysical profiles. The properties of the three types of crude obtained are also listed. S. E. C.

Geophysics.

550.83

739. Geophysical Generalities. R. P. Clark. *Oil & Gas J.*, 16.4.36, **34** (48), 148.—A description of geophysical work in the swamp and marsh territory of the Gulf Coast, detailing the reptilian, insect and other pests which the geophysicist has to combat and the difficulties of handling the heavy equipment in such jungly country. The writer claims a very successful year for geophysics in spite of a few surprising setbacks of geophysical forecasts. Single profile shooting was found to be less reliable than total component work, which is now superseding it. The writer concludes with a table showing that there were 80 reflection seismograph and 34 torsion balance crews at work on the Gulf Coast in 1935. B. F. N. M.

550.83

740. How Physics is Applied in the Oil Industry. P. D. Foote. *Physics*, 1936, **7**, 91–96.—The physicist has to deal with the discovery of oil-fields, drilling, production, transportation, refining, marketing and studies of the physical properties of the finished products. On the first problem, the finding of buried oil-fields, the author points out that there are many instruments and devices put forth with claims to actually discover oil below the surface, but several are not grounded on any scientific principles, while of the remainder only three have attained results which approach a satisfactory exactitude—namely, the gravitational method, the magnetic method and the seismic method, the fundamentals of geophysical prospecting. After describing them, he goes on to the application of geophysics to drilling, such as the correct selection of drilling muds for preventing heaving shales and shutting off water, and the adoption of "colloid physics." Finally he recalls the work the physicist does in the study and control of the physical properties and use of the manufactured petroleum products. B. F. N. M.

550.83(76)

741. Potentialities on the Gulf Coast Spurring Search for Reserves. N. Williams. *Oil & Gas J.*, 16.4.36, **34** (48), 80–87.—In the past five years 85 fields and known salt domes have been found on the Gulf Coast, exclusive of numerous prospects indicated by geophysical work, many of which are accepted as domes or structures, although as yet no production has been opened up.

With the above additions, the Gulf Coast fields total 139, of which 19 salt domes have not yet been producers and 16 areas, showing oil or gas, are not producing at present, leaving 104 actually productive fields. The total recoverable reserves of all these fields is estimated at about 3000 million brl., of which nearly 1150 million brl. had been produced up to January, 1936.

The great number of new discoveries and the size of the reserves created have not slackened, but have increased exploration work, and more geophysical crews (now approx. 125) are operating in the district than ever before. With improvement in exploration and increased geophysical efficiency, the structural and stratigraphical possibilities for oil pools are being greatly extended. Swamps, bays, lakes and other water-covered areas are now being, or about to be, explored. A major geophysical exploration programme in Galveston Bay has been initiated, which may take several years to complete.

At present the relative density of fields and domes to acreage is greatest in the Texas coastal district in a belt about 100 miles wide from the coast inland. With 80 fields or domes the density is one field to 136,920 acres. In the Louisiana coastal area 59 fields give an average density of one field to 286,828 acres. The Texas area is more accessible and favourable as regards surface conditions than the Louisiana area, and the first productive field on the coast (Spindletop) naturally provoked the earliest and most intensive exploration. On the theory that the relative density of the Louisiana fields will be increased to equal the present density of Texas, there should

be 123 fields as against the present 59, as and when exploration spreads over coastal Louisiana. In certain selected areas the density can be shown to be as high as one field to 53,000 acres on the entire coastal area, and on this basis if intensive exploration is given to the whole Gulf Coast area, the total number of fields to be discovered will be materially increased.

Sedimentary formations have been estimated as being 20,000–25,000 ft. thick. Present-day drilling equipment is believed to be capable of going down to at least 15,000 ft., but engineering skill in controlling formational conditions has not yet proved its competence to reach that depth. Four tests have been drilled to below 10,000 ft. Deepest production is from four wells flowing at 9500–9600 ft., and at that depth the wells are in the Miocene, whereas farther west at shallower depths many coastal fields produce from the underlying Oligocene and Eocene. Formations in the Gulf Coast region are stated to thicken both coastwards and eastwards into Louisiana.

With experience and increased skill it is undoubted by operators that wells will be drilled successfully to depths of 15,000 ft., and such depths will "no longer be prohibitive." B. F. N. M.

550.83(76)

742. Exploring in Marsh and Water Areas of Louisiana and Texas Gulf Coast. J. W. Finde. *Oil & Gas J.*, 16.4.36, **34** (48), 143.—These areas in Louisiana, having had very little work done on them, are virgin ground for exploration, and are held in large tracts mainly by fur Companies. The almost entirely marsh country is covered with grass from 1 to 8 ft. high. In marsh and water territory, geophysics, by the use of torsion balance and the seismograph, have obtained as good results as those in any other areas. The principal difficulty is that of transportation; suitable boats for the water area must be partnered by "marsh buggies," which are light motor cars with changed gear and wheels increased to a width of 3 ft. by fixing wooden slats held in place by steel hoops. Good transportation equipment is essential. Seismograph equipment must be built to withstand the excessive moisture and rugged enough to work properly after rough handling. Most of the reflection seismograph work in the tidewater area has been marsh work. Some water work in lakes and bays, but a very little in the Gulf. Surveying is an added trouble, since few bench marks are available. B. F. N. M.

550.83(81)

743. Geophysical-Geological Study of the Sao Pedro Area, Brazil. M. C. Malamphy. *Am. Inst. Min. & Met. Tech. Publn.*, 696, Feb. 1936, 3–25.—Outcrops of bituminous schists and sandstones impregnated with heavy asphaltic petroleum first directed attention to the Sao Pedro area as a potential source of a commercial production of petroleum. Since 1920 more than 20 wells were drilled, giving some oil shows and small quantities of natural gas. In 1934 magnetometer and torsion balance surveys were made. The author gives the results of this geophysical work, explaining them with the aid of 12 figures and four Tables. From the geological-geophysical data he decides that igneous intrusions as laccoliths with sills and dikes have been the main cause of the secondary domes mapped by geologists. Faults presumed by the geologists are not clearly evidenced by the geophysical work. The basement rocks dip slightly to the S.W. and will be reached only at depths greater than 2000 metres. The upper beds have been proved to be non-petroliferous and, although probably older sedimentaries underlie the glacial beds, it does not appear likely that they contain petroleum. The final conclusion is that, on the basis of the geophysical-cum-geological data, the secondary domes are due to laccoliths of igneous rocks, and there is little probability of discovering oil in commercial quantities in this region.

B. F. N. M.

550.834

744. On the Propagation of Sinusoidal Movement of the Ground. G. A. Schulze. *Zeit. für Geophysik*, 1935, **11**, 307–321; *Geoph. Absts.*, 1936, No. 84, p. 1788.—A method is given for measuring the velocity of propagation of artificially produced sinusoidal movements of the ground, 1350 M./sec. was obtained for the upper shell

limestone at a frequency equal to three cycles per second. The dependence of the velocity from frequency was examined. Changes of frequency in the oscillation of the ground, caused by starting an engine, produced at a certain distance pulsations. The latter were explained by the coincidence of waves of different periods, which propagated by two different courses and with different travel time. From these measurements the thickness of the uppermost layer could be determined.

550.834

745. Problems and Progress on the Geologico-Seismological Frontier. J. B. Macelwane. *Science*, 1936, **83**, 193–198.—This is an address by the retiring Vice-President of the Section of Geology and Geography of the American Association for the Advancement of Science, in which he hails the realization of the convergence and interdependence of Geology and Geophysics, and in Geophysics particularly of Seismology. After pointing out the difference in frame of mind and in training of geologists and seismologists, he claims they are both working towards arriving at identically definite results, but, while the geologist's background is varied, being mineralogical, petrographical, stratigraphical and palæontological, it will seldom be physical and mathematical which is the real background of the geophysicist. The combination and collaboration of these two very different outlooks with divergent methods has been very successful in working out most puzzling features of underground earth structure.

The question of the normal depth of focus of earthquake waves is discussed in connection with outer crustal faults, and with regard to the theory that thermodynamic causes may be part of the process in ordinary earthquakes, then geological faults may not tell the whole story. In conclusion, the author thinks that the entire picture of positive geological results attained by seismological methods and of the better understanding and willingness to co-operate of geologists and seismologists foreshadow an exceedingly interesting era of geologico-seismological research.

B. F. N. M.

550.834

746. Successful Application of Seismic Reflection Method in the Ruhr Mining Industry. H. Luckenrath. *Gluckauf*, 1936, **72**, 236–238; *Geoph. Abstr.*, May 1936, No. 85, p. 1812.—The author gives a description of a seismic reflection method of prospecting applied in Walsum Mines (Lower Rhine) for finding the depth of the carboniferous horizon, and especially the depths and directions of the post-carboniferous dislocations in the upper part of the earth's crust. Three main reflecting horizons were established: the chalk horizon, the variegated sandstone horizon and the Zechstein layer. The depths and inclinations of the reflecting surfaces were determined. Two profiles and one plan showing the results of the measurements and the course of the dislocation are given.

550.837 : 608.3

747. Patents on Geophysics. E. E. Turner, Jr. U.S.P. 2,033,160, 10.3.36. Method and apparatus for measuring depths. This invention relates to distance, more particularly to depth finding. It claims advantages over the prior art in the ease of obtaining the desired results, in the minimum of apparatus as regards costs, and in the great accuracy. As contrasted with some of the prior methods, this system employs a hammer-striker which is designed to have a high damper and high movement of sound amplitude in order to provide a device which co-operates with the particular receiving circuit, which also responds to a signal of high increment. Twelve claims.

B. F. N. M.

Drilling.

622.242.2 : 621.313.1

748. Modern Electric Portable Rotary Rig. T. B. Flood. *Petr. Eng.*, April 1936, 7 (7), 44.—A light weight, readily portable electric rig capable of drilling to 3000 ft. by the rotary system has recently been put into operation in the West Texas area. The current for the motor drive is supplied from a portable oil-field sub-station.

L. V. W. C.

622.243.3

749. **Tideland Development and Directional Drilling.** W. A. Sawdon. *Petr. Eng.*, April 1936, 7 (7), 27.—The cost of drilling vertical wells in a tideway lease is very high on account of the pier construction necessary. Controlled directional drilling enables economies to be made in the number of piers required for the efficient drainage of a large tract.

Two methods of directional drilling have been utilized in the Elwood field, California, one in which a single derrick is employed for the drilling of two or three wells, and the other in which adjoining derrick locations are employed with each interior leg foundation pier serving for two derricks. A combination of these two systems provides a unit for drilling seven wells.

Minimum pier construction is shown by drilling two wells from one derrick location, but greater effective drainage of the more oceanward half of the area is possible with the seven-well unit.

Deflections of the wells have been obtained both by whipstocks and knuckle-joints, the majority with the latter tool. Four to five deflections are required for the average well, but occasions have occurred when as many as 30 have been required.

Constant surveys for direction and inclination are required during the entire drilling time.

The amount of weight carried and the speed of rotation of the bit need considerable attention, as both influence the horizontal and vertical directions of the well, and must be varied to meet the conditions encountered. L. V. W. C.

622.243.3

750. **An Infallible Eye, 9000 Ft. Down.** G. L. Kothny. *World Petr.*, 1936, **7**, 253.—The suspicion that crooked holes were the general rule rather than the exception was only born some 10 years ago, by the discovery that the results of many crooked holes were detrimental to every aspect of development and production. This initiated the research of oil producers, engineers and scientists towards the development of well-surveying instruments giving more accurate records than the methods known and used in the past. Well-surveying instruments have now been devised which give such reliable records that they are accepted by the Courts of the U.S.A. as final proof in underground trespass cases. These instruments have led to the development of directed drilling, now a practical art, enabling the operator to complete wells within a reasonable horizontal distance from the derrick site. Accurate and reliable well surveying is essential to directional drilling.

A reliable survey can be made by the use of an automatic self-checking gyroscopic instrument, demagnetized to underground ore-bearing strata or to lost piping or tools in the hole, and the accuracy of which is not affected by the tortuosity, torsional resistance and human errors in sighting, such as may occur by the use of drill-stem orientation. A description with six illustrative figures is then given of a Surcoil gyroscopic clinograph, which uses a gyroscopic directional indicator recording the true N.–S. direction, and the precession property of the gyroscope is adopted in compensating the gyroscope for the earth rotation. The gyropointer, oriented to true N., is balanced so that it will remain true N. during the survey. The instruments and methods of operating are then described in detail and the main advantages summarized. Two figures illustrate the formulæ whereby the true vertical depth and the departure are calculated.

The results of several hundred surveys show :—

1. That there is not one absolute straight hole.
2. That the majority of holes spiral in a clockwise direction unless exceptional conditions exist.
3. That holes with very small angles of inclination spiral more than those with large angles of inclination.
4. That when reaching large angles of inclination holes nearly always drift off in one vertical plane.

Controlled directional drilling is then discussed and the economical advantages of its use in particular cases. Figs. 9, 10 and 11 illustrate three cases. No. 9 shows wells sited on the sea-shore and made to deflect oceanwards through a fault plane so as to strike the oil-sands where they lie vertically below the ocean bed.

No. 10 shows wells drilled on opposite flanks of a buried salt-dome. One is drilled to touch the edge of the cap-rock and to divert under the overhang of the cap-rock and strike the oil pool where it is sealed off against the salt plug. On the other flank the well passes through the cap-rock into the salt plug, and is then diverted outwards to strike the oil pool.

No. 11 shows a series of wells drilled on either side of a hill. Those on the steep escarpment side are diverted through a fault plane to strike the oil-sand at its high point. Those on the lowest surface of the dip slope side are diverted in the opposite direction to reach the oil-sand up the dip from the surface sites.

Three things are required for directional drilling: 1. A deflecting tool. 2. An apparatus to orient correctly the deflecting tool. 3. An accurate surveying instrument to check the progress of the directed drill hole.

Directional drilling is now extensively used in the United States for legitimate purposes, but it has been established in the U.S. Courts that under present statutes the owners of a crooked hole are liable financially for every barrel of oil taken from under the surface of an adjoining tract, whether the trespasser was innocent or wilful.

B. F. N. M.

622.243.5

751. Nickel Alloys in Rotary Drilling. K. Kallos. *Oel u. Kohle*, 1936, **12**, 389–394.—A description is given of the working requirements for each component of a rotary drilling outfit. A table shows the chemical composition and mechanical properties of special alloy steels regarded as best suited for the various items of equipment.

P. G. H.

622.245

752. Rodessa Field Presents some Unusual Deep-Well Drilling Problems. N. Williams. *Oil & Gas J.*, 26.3.36, **34** (45), 47.—Like many new fields, Rodessa in N.W. Louisiana has presented a number of unusual conditions and drilling problems. The first trouble experienced in drilling at Rodessa is in the Nacatoch formation, at 2100–2400 ft., which has a tendency to cave and stick the drill pipe. By proper conditioning of the drilling fluid, using a mud of high colloidal content to build up the walls, the Nacatoch may be negotiated successfully.

Frequent twists-off have been characteristic of drilling the hard formations, particularly massive anhydrite, encountered below the Nacatoch. It was formerly the practice to carry a light weight on the pipe and turn at 90–100 r.p.m. using two-cone rock bits, but under new practice the speed is being slowed up to 70 revs. and three-cone bits are employed.

The Oolitic limestone horizon underlying the anhydrite, and in which production is found, is easy digging, but trouble is experienced in getting back to bottom with the bit often coming out of the hole and in running the casing and cementing. The drilling mud gels and solidifies rapidly in the bottom of the hole. The formation is very porous and honeycombed with small fine pores. Another peculiarity is the high bottom-hole temperature, about 195° F. Bottom-hole pressure is 2500 lb. At present it is necessary to get the casing to bottom, fluid being pumped down through the casing at pressures designed to wash the drilling mud from the bottom. Cementing is also handicapped by the caking mud.

L. V. W. C.

622.245

753. Improved Drilling Speed and its Influence on Cost. E. C. Scott. *J.I.P.T.*, 1936, **22**, 285–304.—A lecture with discussion at the Trinidad Branch on recent improvements in machinery and methods of drilling used in U.S.A. which have resulted in increased drilling speed and their application in a modified form in Trinidad.

G. R. N.

622.245.33

754. Fibrous Materials Aid Restoring Lost Drilling Well Circulation. A. Langton. *Oil & Gas J.*, 23.4.36, **34** (49), 31.—Lost circulation in rotary-drilled wells may occur when (1) an extremely porous water or depleted oil-sand is exposed in the open hole,

(2) gravel formations are drilled through, (3) fractured or fissured formations are penetrated, (4) large creviced or cavernous areas are penetrated. The principle of restoring lost circulation is to plug the pore spaces or crevices by the introduction of suitable materials into the well. The plug or seal must be built up so that it will withstand the pressure of the fluid column in the well. Cottonseed hulls, beet pulp, straw, chopped rope, hay, peat moss and various fibres have been tried with varying success. Where loss of circulation is incomplete, or where loss is taking place into a sand, a mixture of highly concentrated colloidal clay—such as aquagel—and water will regain circulation. The operator rarely knows into what type of formation his mud is escaping, and should try appropriate remedies for leakage formations in the following order: porous sand, fractured or slightly creviced strata, highly fissured and cavernous formations. The seal must be made on the inside of the thief structure, as external seals will be damaged when the bit is withdrawn. All these types of lost circulation can be overcome by the use of gel-cement, ordinary portland cement with a small percentage of aquagel. However, it is necessary to allow about 24 hours for setting, after which time any excess cement must be drilled out. Various chemicals, depending for their effect upon the formation of a plastic mass or hard solid in the thief structure, have been tried. These include calcium chloride and sodium silicate, aluminium sulphate and sodium silicate. They are expensive to employ, and there is also the risk that the setting action may take place before the drill pipe can be removed. An apparatus is described for determining the value of various fibrous materials as aids to restoring lost circulation. This consists essentially of a cylindrical testing chamber in which fibre-bearing drilling muds are forced upon synthetic porous formations at pressures of 3000–5000 lb. per sq. inch. Pressure is obtained from a hydraulic pump, which drives a piston or plug through a second cylinder containing the fibre-carrying liquid. From this pressure cylinder the fluid is forced directly upon the formation contained in the test chamber. A description of the drilling muds, synthetic formations and fibres employed is given. L. V. W. C.

622.248.34

755. New Aids for Drilling Heaving Shale being Tried. K. C. Sclater. *Petr. Eng.*, April 1936, **7** (7), 31.—Great reliance has been placed on the efficacy of sodium silicate mud and the maintenance of continuous circulation in a deep wild cat well in an effort to prevent heaving while drilling through great thicknesses of shale.

This and a number of other methods are referred to. L. V. W. C.

622.24 : 608.3

756. Patents on Drilling Plant. H. C. Otis. U.S.P. 2,036,537, 7.4.36. A stuffing box for rotating elements with means for passing a cooling fluid to dissipate the heat generated.

R. A. Davis and J. F. Mummert. U.S.P. 2,037,707, 21.4.36. Pressure tank door.

M. W. Haines. U.S.P. 2,037,896, 21.4.36. A bottom-hole gas bean attached to the lower end of the tubing string with means for uncovering ports in the tube.

L. Spencer. U.S.P. 2,037,938, 21.4.36. A collar breaker for tubing having an explosive actuated portion for splitting a collar engaged by the fingers of the tool.

W. T. Wells. U.S.P. 2,037,955, 21.4.36. A tool for splitting a collar of a tubing string by means of a gun unit.

J. J. Jakosky. U.S.P. 2,038,046, 21.4.36. An alternating-current process for determining the character and the thickness of the geological formations traversed.

H. W. Fletcher. U.S.P. 2,038,426, 21.4.36. Plunger lift apparatus with the plunger operated by the pressure of gaseous fluid to raise a load of liquid from the well.

E. W. Patterson. U.S.P. 2,038,441, 21.4.36. A fluid lift pump containing means for lifting oil to a position above the level of the oil in the well and an air lift for raising the liquid to the surface.

J. Paul. U.S.P. 2,038,674, 28.4.36. Deep well pump.

J. H. Howard and W. H. Maxwell. U.S.P. 2,038,791, 28.4.36. Core drill.

J. H. Howard and A. C. Catland. U.S.P. 2,038,792, 28.4.36. Core drill.

J. H. Howard and J. C. Wright. U.S.P. 2,038,793, 28.4.36. Core drill with core catches actuated by downward movement of the inner barrel.

F. N. Schneringer. U.S.P. 2,038,961, 28.4.36. A well-cleaning device consisting of two pistons fitting a perforated well casing and means for anchoring one piston while the second may be moved. A port communicates with the space below the lower piston and a valve controls this port to enable compression to be released within the chamber between the pistons.

G. E. Behnke. U.S.P. 2,039,621, 5.5.36. A well-pumping apparatus consisting of a plurality of pistons attached to the sucker rods.

H. P. Wickersham and H. J. Craig. U.S.P. 2,039,945, 5.5.36. A locked drilling safety joint.

L. A. Layne and H. C. Block. U.S.P. 2,040,263, 12.5.36. Detachable blade rotary bit.

W. Turkington. U.S.P. 2,040,413, 12.5.36. Boiler for oil wells having fluid head pressure with a relief valve adjusted to hold sufficient bottom-hole pressure to effect unloading at the surface.

G. A. Macready. U.S.P. 2,040,619, 12.5.36. A method and apparatus for obtaining fluid samples from wells.

L. G. Gates, H. N. Herrick, O. A. Cavins and W. R. Postlewaite. U.S.P. 2,041,061, 19.5.36. Tool joint cut-off device.

R. M. Ridley. U.S.P. 2,041,209, 19.5.36. A gun perforator having a curved muzzle by which a projectile from the straight bore is deflected as it travels, and another member across the muzzle provides a fluid seal for the muzzle.

J. C. Singleton. U.S.P. 2,041,439, 19.5.36. Combination packer, packer setting tool and bottom shut-off valve.

C. O. Moss. U.S.P. 2,041,508, 19.5.36. Tubing plug valve. L. V. W. C.

Production.

532.542 : 622.276

757. Study of a "Bottom-Hole" Sample from the Crescent Pool, Oklahoma. B. E. Lindsly. *Petr. Eng.*, April 1936, **7** (7), 37.—In order to analyse the transformation of energy involved in flow, a knowledge of the volume occupied by a natural oil–gas mixture at different pressures and temperatures is essential.

Since the gas liberated from the oil flowing in a well remains in contact with oil, pressure–volume relations of the bottom-hole sample were determined by flash liberation for the experiments carried out.

A description is given of the method used in determining PV relations, and the general equations for flow of fluids are determined. L. V. W. C.

622.276

758. Economics of Oil-Producing Practice. C. H. Leib. *Min. and Met.*, 1936, **17**, 291.—It was not until about 1920 that U.S. operators realized that flowing production is the cheapest crude produced. Before the adoption of methods to control flowing wells, resulting from the study of pressures, producers actually preferred to get a well pumping as soon as possible after completion, but experiments on gas-lift and air-lift then showed that large quantities of crude oil could be produced at a lower cost than was possible with the old-fashioned methods. As the geologist had previously fought his way into the oil industry, so the engineer has now made himself essential to the producing organizations. In consequence, immense improvements in drilling machinery and tubular goods have paved the way to the possibility of drilling to depths previously considered unattainable in oil-well procedure. In 1917 J. D. Lewin, in a Bulletin of the U.S. Bureau of Mines, enunciated two important findings: (1) The function of gas dissolved in oil must be fully appreciated; (2) ultimate recovery depends not only on repressuring, but also on the maintenance of pressure. Prolonged study on these lines showed the extravagant waste of reservoir energy by the methods prevailing in 1924, and consideration was given to the function of free and dissolved gases as propulsive powers and to the spacing of wells. Gas–oil ratio and bottom-hole pressures became important determinations, combined with the hope that reservoir pressures might be maintained and would expel all the recoverable oil in the reservoir. The most advanced idea at present is the possibility of recovering all the reservoir oil by the inherent energy without the aid of any outside power. It is unlikely this will ever be achieved, but costs will be lowered to the extent that

better recovery is made. The realization that crude oil can be stored in its natural reservoir and withdrawn as required far more economically than if produced at maximum rates, has almost eliminated fire risks, evaporation and the expensive maintenance of enormous aboveground steel reservoirs. The author then discusses proration, the favourable financial results of controlled production to both producer and consumer, the theory of well spacing according to the conditions of each field and the selection of the best producing practice adaptable to each particular field, and makes a plea that production engineers and other oil technicians should aim at a higher ethical standard and insist that their employers should employ the methods and practices which the technicians know are in the interests of all parties, and particularly should develop courage and avoid mental dishonesty.

The author believes that if wider spacing, unitization and pressure maintenance were universally adopted, producers could conservatively expect a profit of 10–20c/brl. above that realized to-day with the limited application of the improved methods he has discussed.

Among the important matters demanding attention by the technicians are:

(1) Universal adoption of wider spacing according to the conditions of each pool, unitization and pressure maintenance.

(2) Education of public officials and of the public so as to permit, and, when possible, to compel the drilling and producing practices that are here advanced.

(3) Persistent efforts to improve operating efficiency and achieve lower costs and wider margin of profits at about existing prices for crude and products.

(4) Establishing proration on a scientific basis, so that the allowable/well would be coincident with a rate of withdrawal utilizing the reservoir energy to the greatest degree of efficiency. If a uniformly accurate method of estimating reserves can be established, perhaps allowables could be a factor of reserves. B. F. N. M.

622.276.4

759. Character of Water Plays Important Part in any Flooding Operation. L. G. E. Bignell. *Oil & Gas J.*, 2.4.36, **34** (46), 24.—The three necessities for successfully increasing oil recovery from old fields are recoverable oil, suitable water for flooding and fuel for power. A co-ordination of all three elements in proper proportion is necessary if the success of the undertaking is to be assured.

Water is the main factor in flooding, and only properly treated water should be forced into the sand. Any impurities remaining in the water may quite easily seal the pores of the sand with precipitated solids from both the flooding and formation waters. L. V. W. C.

622.276.4

760. Dynamometer Tests Indicate Present Pumping Methods Subject Sucker Rods to Unnecessary Loads. J. F. Eaton. *Oil & Gas J.*, 5.3.36, **34** (42), 24; 12.3.36, **34** (43), 24.—The maximum allowable working stress in pump sucker rods limits the maximum depth from which oil may be lifted by the sucker-rod pump, and often only by exceeding this allowable working stress is it possible to obtain a sufficient production of oil to make operation of the well profitable.

A reduction in rod failures is obtained by reducing the pumping speed or by reducing the length of stroke, or both, or by reducing the pump diameter. A reduction in production follows, however, from these methods.

A series of dynamometer tests has been made with the sucker rods supported on heavy rubber cushions, and the data obtained have revealed the fact that rod loads were reduced without loss of production.

The views put forward suggest that sucker-rod loads could be reduced and performance increased without sacrificing production if the motion imparted to the polished rod by the surface equipment were altered so that the polished rod velocity might vary approximately inversely as the load. These rubber cushions permit the fulfilment of this condition to a limited extent. L. V. W. C.

622.276.4

761. Group Pumping System in Duval County. W. F. Herbert. *Oil & Gas J.*, 16.4.36, **34** (48), 113.—With the development of the need for pumping equipment

to produce wells in Duval County, a new trend in the selection of equipment has been accepted by Gulf Coast operators, which is particularly adaptable for fields where production is from formations above 4000 ft. and is limited by either the producing ability of the formations or proration. The wells have been grouped for convenience and economical handling by a single prime mover and reduction units through rod lines and pumping-jacks. Several factors justify such a course: (1) effective counterbalancing of the rod and fluid load is obtained when two wells are paired; (2) the horse-power requirements, because of this counterbalancing, are materially reduced; (3) the installed horse-power for lifting a group of wells is less than would be required with an individual prime mover at each well; (4) the investment is lower, this being important with restricted production. L. V. W. C.

622.276.4

762. Radiator Cooling System for Pumping Engines Proving to be Successful. H. K. Ihrig. *Oil & Gas J.*, 26.3.36, **34** (45), 50.—A description of an attempt to eliminate scraping of cylinder water-jackets in gas engines used for pumping, by the installation of a closed system of cooling and the tests leading to perfecting the installation.
L. V. W. C.

622.276.56

763. Operating pressure in Bore-Holes with a Single Tube Air–Gas Lift. A. M. Lobkov. *Azerb. Neft. Khaz.*, 1935, **5**, 69–73.—The use of a 1-mm. opening on lift tubes is not economical. The initial pressure in a single-tube bore-hole does not depend on the diameter of this tube or on that of the exploitation tube, or on the static level in these tubes; but is dependent only on the depth of submersion below the static level. To lower the liquid column to a minimum which would permit the attainment of an excessive initial pressure, it is necessary before assembling the armature to pump water through the lift tubes to create the most favourable conditions for a free movement of the liquid from the bore-hole into the oil layer in the process of its forcing. This forcing, or the removal of the plug in the bore-hole, creates simultaneously normal conditions for the flow of the liquid from the layer into the bore-hole.
For. Petr. Techn.

Transport.

622.698

764. Direct-Current Generating Units used for Crude Oil Pumping Stations. W. S. Dyer. *Oil & Gas J.*, 23.4.36, **34** (49), 46.—A description is given of a suitable D.C. generating plant suitable for gathering and main-line pumping stations. The advantages of A.C. and D.C. systems are discussed. The main advantage of alternating current is the safety offered by induction motors, but it is necessary to keep the frequency constant to prevent transformers and motors heating and to maintain the horse-power. This is almost impossible on pump stations where the generating of electricity is secondary to the pumping of oil. The main argument against D.C. for power is the commutator on motors and generators and attendant sparking at the brushes. The proper maintenance of D.C. motors is described.
L. V. W. C.

658.787.6 : 625.245.62

765. Measuring Apparatus for Tank Wagons. Anon. *Engineering*, 1936, **141**, 451–452.—The device described is intended to overcome the errors which often accompany the usual method of measuring motor fuel delivered from a wagon to a customer's storage. It consists of a rectangular compartment fitted with a flap valve, and to the latter is attached a spherical float, which rises at the entry of liquid, thus lifting the flap valve. The fuel then goes through a filter and on through a meter. To ensure that no entrapped air passes through the meter at the commencement of a delivery, a vent situated at the top of the float chamber is connected to the wagon by a pipe; the air, being unable to lift the valve, is by-passed back to the wagon. The flap valve is unaffected by tilt, *i.e.*, should the vehicle be standing on sloping ground, and further it works equally as well under gravity as when deliveries are

being pumped. The apparatus, which is patented, is suitable for other fuels such as diesel fuel-oil. Photographs and drawings are given. W. A. W.

Gas.

621.431.72

766. Water-Gas Reaction Apparently Controls Engine Exhaust Gas Composition. G. W. Gleeson and W. H. Paul. *Nat. Petr. News*, 19.2.36, **28** (8), 25.—It has often been suggested that the water-gas reaction $CO + H_2O \rightleftharpoons CO_2 + H_2$ controls the composition of the exhaust gases from I.C. engines. Further light has been shed on the problem by an investigation in which controlled proportions of CO_2 or water have been introduced into an engine while continual exhaust gas analyses were carried out. It was found that the addition of water decreased the CO/H_2 ratio and the addition of CO_2 increased it, whilst the addition of water increased and the addition of CO_2 decreased the ratio H_2O/CO_2. This was to be expected. However, it had been anticipated that the H_2O/CO_2 ratio would vary to a much greater extent than the CO/H_2 ratio, but such was not the case. The primary change took place in the diminishing of the constituent that accompanies the added body. This is taken as an indication that the added body enters the reaction. The general conclusions may be summarized as follows:—1. The water-gas reaction controls the composition of exhaust gases from I.C. engines; 2. The ratio CO/H_2 influences the value of the water-gas constant to a greater extent than the ratio CO_2/H_2O does; 3. There is no selective combustion of any constituent of the fuel in the engine. H. G.

665.521.1

767. Liquefied Petroleum Gas. W. H. Bateman. *Refiner*, 1936, **15**, 135–138.—From 1922 to 1934 the output of liquefied petroleum gas has expanded from 222,000 gall. to 48,173,000 gall., the year 1934 showing an increase of 24% over 1933; the number of bottled-gas customers is in excess of 240,000 in U.S.A. The tendency to include butane in gasoline fuels will probably result in raising the amount of propane in the bottled gas. Problems of distribution of this product are being solved as custom increases, and besides tank-cars, truck and trailer units can be employed for distances up to 100 or even 300 miles. Among the major producers the specifications of the various liquefied petroleum gas products have been fairly well standardized. Typical specifications are as follows: Industrial propane should be at least 70% propane and/or propylene by liquid vol. shall have a vapour pressure not greater than 225 lb. at 105° F.—not less than 50% by vol. should evaporate below — 25° F.—shall be free of H_2S and not contain more than 15 grains total sulphur per 100 cu. ft. vapour. Commercial propane shall be at least 95% propane and/or propylene, pass the above tests as well as the cobalt bromide dehydration test and not give more than a 2% residue by the mercury freezing test. Commercial butane shall be composed mainly of butanes and/or butylenes; its vapour pressure should not be more than 75 lb. at 105° F. and not less than 95% by vol., should evaporate below 34° F. Sulphur and hydrogen sulphide specifications should be the same as those for propane. The format of the tests and their significance are described. The bottled gas was primarily used for domestic heating, but now its utilization has extended to larger domestic appliances, and to the industrial fields of plant space heating, oven heating, metal cutting, refrigeration and use as fuel in I.C. engines. Liquefied petroleum gas is sold at 5–10 cents per gall. G. R. N.

665.53

768. The Conversion of Cracking Gases into Liquid Products of Value. R. Fusstoig. *Chim. et Ind.*, 1936, **35**, 1022.—Brief reference is made to various processes previously proposed for absorbing ethylene from cracking gases. A method tried involved passing the gases through sulphuric acid at gradually increasing strength containing 1% silver chloride and 0·3% copper chloride as a catalyst. Difficulties were found in providing sufficient contact between acid and gases while the butadiene in the gas was converted by the sulphuric acid to mercaptans. The use of selective adsorption by active carbon gave more satisfactory results. By passing 25 litres of gas through 100 gm. of active carbon at a rate of 30 litres per hour, only saturated hydrocarbons

and ethylene passed, all other unsaturateds being adsorbed. In the proposed plant the cracking gases, after drying, are passed through a column containing quartz, and then through the active carbon adsorber. The ethylene is then absorbed in sulphuric acid. When higher olefines, recognized by the melting points of their bromides, begin to pass the active-carbon adsorber, a second one is brought into action while the first is regenerated. The higher olefines, driven out by steaming, are passed through saturated copper chloride to absorb the butadiene and then through sulphuric acids of varying strengths to absorb selectively the different olefines. In this way ethyl, butyl, and amyl alcohols, etc., can be obtained in a high degree of purity. E. G. H.

66.074.37 : 608.3

769. Patents on Gas. R. H. McKee and E. A. Winter. E.P. 445,319, 7.4.36. Recovery of carbon dioxide from waste gases by introducing into a filling tower containing potassium carbonate solution, ammonia and water above the alkali level. The gases are introduced below the level of the alkali, the waste gases discharged and carbon dioxide recovered from the alkaline bicarbonate and ammonium salt of carbonic acid.

665.521.1 : 608.3

W. H. Owen. E.P. 446,268, 27.4.36. An apparatus is described for the removal of solid or liquid matter from gases or vapours.

66.074.37 : 608.3

J. Y. Johnson. E.P. 446,435, 30.4.36. Apparatus for the manufacture of mixtures of nitrogen and hydrogen practically free from oxygen and oxides of nitrogen by burning ammonia in the presence of nickel as catalyst.

66.074.37 : 608.3

M. P. Youker. U.S.P. 2,040,455, 12.5.36. Combined stabilization and gas conversion process.

66.074.37 : 608.3

Woodall-Duckham, Ltd., and A. T. Kent. E.P. 445,638–445,639, 16.4.36. Improvement in the method of producing a mixture of coal-gas and water-gas in intermittent vertical chambers, ovens or retorts. Water-gas is produced in one chamber, while the coal is carbonized in the remaining chambers of the group. Valve-controlled connections between the upper end of each chamber and the water-gas and gas off-take mains are provided.

665.542.2 : 608.3

A. M. Clark, W. E. Batten, C. F. R. Harrison and I.C.I., Ltd. E.P. 445,711, 16.4.36. Recovery of sulphur dioxide from gas mixtures by means of a solution containing basic aluminium sulphate as an absorbent liquor.

66.074.37 : 608.3

V. Ipatieff. U.S.P. 2,035,889, 31.3.36. Method of purification of fuel gases containing gum-forming olefins and converting the latter into more valuable products. The gas is scrubbed with a mixture of sulphuric acid and aromatic hydrocarbons to form alkyl–acyl derivatives when the gum-forming olefins are separated from the gas. The purified gas and derivatives are then recovered.

66.094.37 : 608.3

W. W. Triggs. E.P. 446,720, 5.5.36. Gaseous reactions such as those involving catalytic vapour-phase reactions of organic compounds and oxygen-containing gases, are controlled by withdrawing a portion of the mixture of compound and gas being supplied to the catalytic converter. The compound is converted in the catalytic chamber by oxygen in the presence of activated vanadium oxide supported on partly dehydrated alumina, to oxides of carbon which are measured.

661.715.33 : 66.093.4 : 608.3

Standard Oil Development Co. E.P. 446,781, 6.5.36. Hydration of olefines by passing them in the vapour phase upwardly through a reaction zone counter-current

with aqueous sulphuric acid at 250–350° C. and under 100 atm. pressure. The acid is maintained at a constant strength of 1–10% and the alcohol concentration is maintained below equilibrium value by adding a fatty acid to the reaction zone.

661.725.4 : 608.3

Marsene Corpn. of America. E.P. 447,110, 6.5.36. Preparation of butadiene or diolefine hydrogen chlorides and their derivatives for use in the manufacture of thin, transparent flexible sheet material. The reaction material is subjected to the action of dry hydrogen chloride gas under pressure. W. S. E. C.

Crude Oil.

665.4(438)

770. Analysis of Polish Crude Oils. K. Katz. *Publicn. of Karpacki Geol. Inst. Naftowy*, Boryslaw. Bulletin 25, 1936. *Petr. Zeit.*, 3.6.36, **32** (23), 9.—Fifty samples of crude oils from Boryslaw, 54 from Revieres Drohobycz, 47 from Revieres Jaslo and 35 from Revieres Stanislawów were investigated. These were divided into four classes—namely, those containing (1) more than 66% of aliphatics or isomers, (2) more than 66% of naphthenes, (3) methane and naphthenes in equivalent amounts or methane or naphthene content not above 66%, and (4) aromatic or unsaturated hydrocarbons in larger quantities, or terpenes. Several tables are given of values for specific gravity, Engler distillation figures, viscosities, set points, and of the content of wax and hard asphalt. A complete bibliography of references is appended. W. S. E. C.

665.51

771. Preliminary Caustic Treatment of Crude Oil. V. T. Brazhnikov. *Azerb. Neft. Khoz.*, 1935, **5**, 91–94.—A saving amounting to 42% of acid and 75% of caustic was obtained by using a preliminary caustic treatment of the crude oil. The oil after being passed through fuel-oil heat exchangers and towers heated with closed steam was brought to 65–70° C., and then passed through a pipe-line with inlets for a dilute caustic-soda solution which was injected into the line. The mixture passed along a 5-metre section of the pipe and into a heated settler, from which the crude passed to Borrmann stills. The consumption of caustic was 0·266% and the oil loss 2·42%. Better quality refined products were obtained. For. Petr. Techn.

665.51

772. Bacteriological Method of Desulphurizing Crude. A. A. Maliyantz. *Azerb. Neft. Khoz.*, 1935, **6**, 89–93.—The experiments were carried out with a variety of Russian crude oils using as culture media the bacteria "Spirillum æstuari." It was found that, in addition to a certain decomposition of the sulphur compounds, the crude oil itself is attacked and oxidized. H_2S and H_2SO_4 were formed and the amount of carbonates was increased. The bacteria do not act in an alkaline medium. Twelve references. For. Petr. Techn.

Chemistry and Physics.

547.2

773. Relation between the Constitution and Viscosity Characteristics of Hydrocarbons. W. R. Wiggins. *J.I.P.T.*, 1936, **22**, 305–327.—A comprehensive examination of the literature on the viscosity–temperature relationships of petroleum oils and of hydrocarbons that may occur in petroleum, and the influence other physical properties may have on these relationships. G. R. N.

547.213

774. Freezing Point and Boiling Point of Propane. M. M. Hicks-Bruun and J. H. Bruun. *J.A.C.S.*, 1936, **58**, 810–812.—A sample of pure propane was prepared by subjecting a commercial sample of propane, of the highest purity obtainable, to treat-

ment with chlorosulphuric acid in lead-lined steel bombs. This treatment was followed by a treatment with sodium hydroxide and by distillation in a special twenty-plate all-glass still. The fractions finally obtained were found to have the following constants: b. pt. $-42{\cdot}17 \pm 0{\cdot}05°$ C. at 760 mm., f. pt. $-187{\cdot}1 \pm 0{\cdot}1°$ C. The freezing point found indicates that the generally accepted value is nearly 3° too low, but also that the value found is lower than the freezing point of methane.

W. E. J. B.

547.313

775. Physical Constants of Polymerization Products of Unsaturated Hydrocarbons. H. I. Waterman, J. J. Leendertse and J. P. Makkink. *J.I.P.T.*, 1936, **22**, 333–340.—The density and viscosity–temperature relationships of a series of polymer fractions obtained by treating a mixture of branched pentenes with $AlCl_3$ at 0° C. are given and discussed.

G. R. N.

547.3 : 14.2

776. Preparation of Dialkylacetylenes from Acetylenic Grignard Reagents and Alkyl Sulphates. S. D. Thorn, G. F. Hennion and J. A. Nieuwland. *J.A.C.S.*, 1936, **58**, 796–797.—The use of two moles of alkyl sulphate per mole of acetylenic Grignard reagent effected smooth alkylation, yielding the dialkyl acetylene in satisfactory yield. The reaction is described in detail for the formation of octine-3 from ethyl sulphate and butyl acetylene magnesium bromide. The following hydrocarbons have been prepared and the paper gives their b.pt.'s, d^{20}_4 and n^{20}_D; ethyl vinyl acetylene, heptine-2, octine-3, nonine-3, nonine-2.

W. E. J. B.

547.512

777. Raman Spectra and Polymerization of *cyclo*Propane by Ultra-Violet Light. L. Harris, A. A. Ashdown and R. T. Armstrong. *J.A.C.S.*, 1936, **58**, 852–853.—Measurements have been made on both liquid and gaseous *cyclo*propane, and the lines of the Raman spectrum determined. The high transmission of *cyclo*propane in the ultra-violet enabled use to be made of the intense 2536 Å. line of mercury for excitation, and fourteen frequencies composed the Raman spectrum of liquid *cyclo*propane. With gaseous *cyclo*propane one strong line only was observed, and it had the same frequency shift as the strongest line in the liquid. During the experiments it was observed that a mercury-sensitized photochemical polymerization of *cyclo*propane occurs under the influence of the 2536 Å. radiation of mercury. The product obtained was a viscous colourless oil, b. pt. about 300° C. at 760 mm. The formula was probably $(CH_2)n$.

W. E. J. B.

547.512

778. Preparation, Boiling Points and Ultra-Violet Absorption of *cyclo*Propane and Propylene. A. A. Ashdown, F. Harris and R. T. Armstrong. *J.A.C.S.*, 1936, **58**, 850–852.—*cyclo*Propane was prepared from trimethylene dibromide, absolute alcohol and zinc wool in an apparatus from which all moisture was excluded. The evolved *cyclo*propane was collected at − 78° C., distilled and subjected to various purifying reagents and finally redistilled. The pure hydrocarbon boiled at − 32·89° C. at 755·9 mm. Impurities were assessed at 0·13%. Propylene was prepared by refluxing *iso*propyl alcohol with phosphoric acid. After separation of di*iso*propyl ether and purification, the pure propylene boiled at − 47·67° C. at 759·1 mm. The absorption spectra were measured with Hilger E 315 and E 370 spectrographs. Both substances were found to absorb continuously in the ultra-violet, and molecular extinction coefficients of each hydrocarbon have been determined. The absorption with *cyclo*propane was similar to that obtained with saturated aliphatic hydrocarbons, *i.e.* high transmission in the region 5000–1950 Å. Propylene absorbs in the region of 2400 Å., the absorption increasing rapidly as shorter wave-lengths are reached. It is suggested that the analysis of mixtures of propylene and *cyclo*propane could be effected by measurements of extinction coefficients at 2000 Å.

W. E. J. B.

547.53

779. Kinetics of Thermal *cis–trans* Isomerizations. V. Butene-2. G. B. Kistiakowsky and W. R. Smith. *J.A.C.S.*, 1936, **58**, 766–768.—The kinetics of the thermal *cis–trans* isomerization of butene-2 have been investigated over the temperature range 663–690° K. The data were difficult to interpret, but it is suggested that the reaction is approximately first order during a run, but of second order with respect to initial pressure. Possibly a chain mechanism is involved. The equilibrium composition of the reaction has been determined at 663° K. and 620° K. At both temperatures, within experimental error, this composition was the same, viz.: 52·8% of *trans*-isomer. W. E. J. B.

547.53

780. Raman Spectra of 2-Methylbutene-1 and 2-Methylbutene-2. D. D. Thompson and M. L. Sherrill. *J.A.C.S.*, 1936, **58**, 745–747.—The Raman spectrum of synthetic 2-methylbutene-1 has been photographed. The Raman spectra of the low and high fractions of the hydrocarbon obtained by the dehydration of tertiary amyl alcohol have been examined. The results indicate that the former is a mixture of 2-methylbutene-1 and 2-methylbutene-2, and that the high fraction is practically pure 2-methylbutene-2. W. E. J. B.

547.53

781. Preparation and Constants of 2-Methylbutene-1. M. L. Sherrill and G. F. Walter. *J.A.C.S.*, 1936, **58**, 742–745.—This hydrocarbon was prepared by the nuclear synthesis method for olefins, developed by Boord and co-workers. This synthesis involves the following stages. α-Chloro ethyl ether → 1 : 2-dibromoethyl ether → 1-bromo-2-ethoxypropane → 2-ethoxypropene → 1 : 2-dibromo-2-ethoxypropane, 1 bromo-2-ethoxy-2-methylbutane → 2-methylbutene-1. The physical constants of this material are b. pt. 31·05 ± 0·05° C. at 760 mm. n_D^{25} 1·3777, d_4^{25} 0·6504, and it does not form peroxides readily, behaving more like pentene-1 than pentene-2 or trimethylethylene, both of which form peroxides readily. The absorption spectra in the ultra-violet were determined for the four hydrocarbons trimethylethylene, pentene-1, pentene-2 and 2 methylbutene-1, and curves are presented of log ϵ against $1/\lambda$. The curves for the four hydrocarbons, although similar, show certain distinguishing characteristics. W. E. J. B.

547.532

782. Homogeneous Catalytic Oxidation of Benzene. R. H. Griffith and S. G. Hill. *Trans. Faraday Soc.*, 1936, **32**, 829.—The paper describes an investigation into the slow oxidation of benzene under pressure in the vapour phase, in the presence of catalysts. The experiments were carried out in glass Pyrex apparatus, the course of the reactions being followed by pressure change.

None of the experiments showed any induction period, but the reaction time was found to depend directly on the benzene–oxygen ratio and on the pressure; and to vary inversely with the absolute temperature and with the amount of ethyl nitrate added as catalyst. The effect of increasing the exposed surface area of the glass was to retard the reaction considerably. Similarly the accelerating effect of ethyl nitrate was counteracted by addition of lead tetra-ethyl to the oxygen–benzene mixtures.

The compositions of the gaseous products of reaction are given for the various experiments. Increase of oxygen gave higher CO_2/CO ratios, but increase in reaction temperature had the reverse effect. The presence of lead tetra-ethyl, or increased glass surface in the reaction zone gave a high residual concentration of oxygen, whilst with increasing concentrations of ethyl nitrate the CO_2/CO ratio decreased slowly until explosion occurred, when the composition of the residual gas mixture changed entirely.

The function of the ethyl nitrate catalyst is discussed, and the decomposition products of pure ethyl nitrate in the same apparatus are given. F. E. A. T.

665.4 : 546.22

783. Sulphur Compounds in Petroleum. G. Free. *Oel u. Kohle*, 1936, **12**, 311–318.—An abstract of published knowledge relating to the nature and examination of sulphur

compounds in petroleum. The total sulphur contents of various crudes are discussed fully. The results and, in some cases, the experimental details are given of researches on the nature of the organic sulphur derivatives. The methods of estimating sulphur in oil are reviewed, detailed mention being made of that of Faragher, Morrell and Monroe (*Ind. Eng. Chem.*, **19**, 1281), which determines H_2S, free S, mercaptans, thioethers, and disulphides. P. G. H.

668.741.2

784. Catalytic Vapour-Phase Nitration of Benzene. R. H. McKee and R. H. Wilhelm. *Ind. Eng. Chem.*, 1936, **28**, 662.—A vapour-phase process is described for the nitration of benzene by means of nitrogen dioxide, using silica gel as a catalyst. At atmospheric pressure and a temperature of about 310° C., an 80% conversion of benzene to nitrobenzene can be obtained, but only by using an excess of nitrogen dioxide. Nitric oxide formed as a by-product in the reaction may be readily converted by air oxidation to nitrogen dioxide, and so used again in the process. H. E. T.

Analysis and Testing.

531.756

785. Quick Method for Correcting Oil Gravities to 60° F. R. Grosholz. *Nat. Petr. News*, 19.2.36, **28** (8), 33.—A chart is reproduced permitting hydrometer readings at temperatures between 30° F. and 90° F. to be corrected to 60° F. H. G.

531.787

786. Improved Micromanometer. H. W. Smith, Jr. *Ind. Eng. Chem. Anal.*, 1936, **8**, 151–152.—Describes a simple and convenient micromanometer adaptable to routine measurements of minute pressures and pressure differentials developed and used by the American Gas Assocn. Testing Lab. It consists of a heavy metal base equipped with levelling screws and indicating levels supporting columns carrying a micromanometer screw assembly and gauge reservoir. The reading meniscus lies in a short length of straight glass tubing inclined at 3° to the horizontal and securely fixed to a brass annular plate that can be rotated and clamped. The liquid reservoir and gauge are connected with thick-walled rubber tubing inclined upwards. At its mid-point the meniscus tube is supplied with a cross hair or engraved hair line. The meniscus is observed through a magnifying eye-piece, and the screw is cut so that one division corresponds to 0·001 inch pressure. Methyl alcohol is used as gauge liquid, since it does not affect rubber tubing, its specific gravity is accurately known and it has a low surface tension. G. R. N.

532.612.4

787. Surface Tension Measurements of Viscous Liquids. A. H. Pfund and E. W. Greenfield. *Ind. Eng. Chem. Anal.*, 1936, **8**, 81–82.—This method is based on the observation that if a small air-jet is allowed to impinge on the surface of a liquid, an indentation or depression is produced, and its depth is an inverse function of the surface tension. The method is best applied to liquids which are non-volatile, viscous and transparent. The liquid is placed in a 10-mm.-thick brass cell with glass windows, and is mounted on an adjustable platform below a glass jet through which air at constant pressure is passed. The liquid is suitably illuminated and a short focus telescope is used to measure the depth of the depression, which should not be greater than 1 to 2 mm. Pure liquids of known surface tension were used to calibrate the apparatus, and the equation obtained was $\gamma = Ka^{-4}$, where K is a constant and a the depth of the depression. The method was used to determine the surface tension of cable oil, and found to be superior to the ring method at temperatures at which the oil was no longer fluid. The air-jet was extremely sensitive to short sound-waves. Possible applications of the method are discussed. G. R. N.

662.927

788. A Low-Temperature Thermostat. G. B. Heisig. *Ind. Eng. Chem. Anal.*, 1936, **8**, 149.—A 3-litre Pyrex beaker is set in a 4-litre beaker, the rim joint being sealed

with rubber solution. The nested beakers are centred in a tin can which holds the thermostatic liquid, *e.g.* acetone, alcohol or kerosine. The can is fixed in a wooden box lined with cork. If a constant temperature is required for a few hours, the can only is filled with the refrigerant, *e.g.* dry ice and alcohol, and when required for long periods both the can and box are filled. The bath is stirred with a turbine paddle connected to an induction motor. Heating of the bath is obtained by use of a small heating coil fitted with a thermostatic control. A temperature range of + 25° C. to − 75° C. can be obtained. G. R. N.

665.41

789. Sulphuric Acid Test for Liquid Paraffin. C. E. Sage and S. G. E. Stevens. *Analyst*, 1936, **61**, 323–327.—Experiments were carried out in which liquid paraffin (viscosity Redwood I. 300 secs. at 100° F.) was treated for various times on a boiling water-bath with 96, 97 and 98% sulphuric acid, and the colour of the acid layer noted in a Lovibond Tintometer. It is considered that the 96% acid specified in the 1932 B.P. is too weak. The reaction appears to be delayed with this acid, but is progressive with 97% acid. Samples will thus pass this test which would fail if slightly stronger acid were used. It is suggested that 97% acid should be used for the test, with a time limit of 10 min. on the boiling water-bath. The tintometer reading should then be not more than 10 yellow and 4 red. C. C.

665.521.2 : 543

790. Determination of Gaseous Olefines or Hydrogen by Catalytic Hydrogenation. W. A. McMillan, H. A. Cole and A. V. Ritchie. *Ind. Eng. Chem. Anal.*, 1936, **8**, 105–107.—The method consists of mixing measured volumes of hydrogen and olefin-bearing gas and passing the mixture over a suitable catalyst at room temperature and substantially atmospheric pressure. The resulting contraction in volume is a direct measure of the amount of olefin present. The apparatus used was two complete Bureau of Standards water-jacketed burette and compensator assemblies with a catalyst tube between them. The catalytic mass was nickel-impregnated asbestos fibre. The method was checked by using known mixtures of carefully purified gaseous paraffins and olefines. The results showed that this method was more reliable and more accurate than the usual absorption methods of determining gaseous unsaturation. G. R. N.

662.753.1 : 543

791. Determination of Aromatics in Saturated Gasolines. A. F. Dobryanski and N. T. Tikhinov-Dubrovski. *Azerb. Neft. Khoz.*, 1935, **5**, 84–86.—The amount of benzene, toluene and xylenes added to an aromatic-free gasoline was checked by the picric acid method. Accordingly the gasoline was separated into 65–95° C., 95–125° C. and 125–155° C. fractions. After the addition of various amounts of the above aromatics (1–100%), the fractions were saturated with picric acid and 10 ml. of the fraction to be analysed were then pipetted into saturated picric acid followed by 5 minutes' agitation. The gasoline mixture was then transferred (leaving the sediment in the flask) into a second flask with 35 ml. distilled water, using another 10 ml. for rinsing the funnel. Three drops phenolphthalein were then added, and the mixture was agitated to transfer the acid into the aqueous solution, the titration being carried out with 0·01*N*-caustic soda to the appearance of a permanent (4–5 minutes) raspberry-red coloration in the lower aqueous layer. The results are tabulated, and it is claimed they are accurate to ± 0·02%. For. Petr. Techn.

66.046.8

792. Preparing Welding Electrodes. Y. R. Raikhlin and A. M. Zarkhin. Russ. P. 39,285, 31.10.34.—A powder containing a high-melting metal such as tungsten or molybdenum, etc., or its high-melting combination with carbon is mixed with a solution of latex and gasoline. The mixture is dried, passed through a fine mesh and the obtained material is then used for pressing rods, which are finally impregnated (after baking) with an alloy of copper and aluminium (in a fused state) or with another good metallic electric current conductor. For. Petr. Techn.

Refining and Refinery Plant.

66.044.1

793. Preparing Welding Electrodes. Y. R. Raikhlin and A. M. Zarkhin. Russ. P. 38,715, 30.9.34.—Electrodes are prepared from powdered hard metals such as tungsten, which are covered (electrolytically or by substitution) with a metal layer of good conductors such as precipitated copper. For. Petr. Techn.

66.048 : 657.472.14

794. Cost of Steam and Heat in the Refinery. W. L. Nelson. *Refiner*, 1936, **15**, 139–141.—An article presenting comparisons of the cost of generating steam and the cost of absorbing heat in a pipe-still for the conditions that exist in refineries. Summarized data from twelve refineries showed that steam cost could be formulated as $C_s = 25{\cdot}4\ \frac{C_f}{E} + 0{\cdot}029\ C_o + 0{\cdot}025\ C_M + 2 + 0{\cdot}12\ C_T + C_D$, where C_s = cost of generating steam, cents per 1000 lb., C_f = cost of fuel, cents/brl., C_o = cost of operating labour, cents/hr., C_M = cost of manual labour, cents/hr., C_D = cost of depreciation, cents/1000 lb. steam generated, C_T = cost of treating chemicals, cents/1000 gall. water, E = percentage efficiency of generation. Tables are then given of the allocation of steam consumption in topping and cracking units and in complete refinery plants. With the aid of these it is possible to estimate the steam cost of the complete processing of a crude oil from its laboratory evaluation. With regard to the cost of absorbing heat in a pipe-still the following two equations are given: $C_h = 17{\cdot}7\ \frac{C_f}{E} + 0{\cdot}035\ C_o + 0{\cdot}021\ C_M + C_D + 1{\cdot}5$ for distillation units and $C_h = 17{\cdot}7\ \frac{C_f}{E} + 0{\cdot}039\ C_o + 0{\cdot}05\ C_M + C_D + 2{\cdot}2$ for cracking units, in which C_h is the cost of absorbing heat, cents/million B.Th.U. G. R. N.

66.048.3

795. Design of Fractionating Plate. J. A. Campbell. *Refiner*, 1936, **15**, 127–134.—After a general discussion of his experiences in plate design, the author states it is important to have a large number of jets to secure intimacy of contact, which favours the perforated plate, and to have a positive seal so that oil and gas will always contact above the plate which favours the bubble-cap plate. A plate was designed to combine these advantages, the jets being in the form of small valves that would open proportionally to the gas flow and maintain relatively high and approx. constant slot velocity securing a perfect seal at all rates of gas flow. Rivets, with conical head and split shank, were die cast of a strong, tough light alloy with four ribs $\frac{1}{32}$ inch high on the conical surface. The rivets were passed through the 6600 openings of each plate. The four ribs divided each opening into four, making a total of 26,400 jets per plate. The head of the rivet was $\frac{3}{8}$ in. diameter, the shank $\frac{5}{16}$ in. The jets were fan-shaped, and interfered with each other by lateral projection, so that a large volume of fine froth resulted. The overflow tubes were therefore given extra height, being 4 ins. An absorber 7 ft. in diameter under 30 lb. pressure and circulating 360 gall. oil per minute could strip 8 million cu. ft. gas per day. Comparison with a normal perforated plate absorber showed that the latter required more oil to give the same result. Less oil circulation in the new absorber connoted colder oil, and therefore the greater the saving for a plant of given capacity. By leaving the rivet heads rough the gas could be stripped almost completely of *iso*pentane and higher hydrocarbons, whilst when they were cleaned smooth the butanes could be taken out. The extended application of this high-efficiency plate was then discussed.
G. R. N.

66.067.75 : 661.183.7

796. Silicic Acid as a Decolorizing Medium. E. Erdheim. *Petr. Zeit.*, 13.5.36, **32** (20), 1.—The silicic acid used in this research contained 20% of water and a small quantity of iron. It was dried at 120° C. and used in powder form. Several other samples of the acid were prepared by heating this sample at 400° for 1 hr., with

sulphuric acid or aluminium sulphate and neutralizing. The samples were used to decolorize Schodrica lubricating oil in benzene solution, and the decolorizing values assessed as described in Abstract 560 and compared with Montana S.

The results showed that silicic acid is not so efficient as highly activated bleaching earths, but could be used to decolorize light mineral oil products. It could also be applied in conjunction with more highly activated bleachers, and so render the bleaching process more economical. W. S. E. C.

66.067.75 : 661.183.3

797. Effect of Bleaching Earths in Different Media. E. Erdheim. *Petr. Zeit.*, 6.5.36, **32** (19), 13.—In continuation of the author's work (Abs. 560), solutions of Bismarck brown in different solvents were investigated, *e.g.* in 95% alcohol, distilled water with and without the addition of hydrochloric acid, 50% glycerol, resin solution containing a little caustic soda, chrysoidin solution with and without hydrochloric acid. Eleven bleaching earths were used to decolorize these solutions. The results are tabulated, and it is shown that the decolouring power varies with the solvent. W. S. E. C.

66.094.57

798. Desulphurization of Hydrocarbons with Carbon Monoxide. B. W. Malishev. *J.I.P.T.*, 1936, **22**, 341–346.—Experiments are described which show that toluene can be freed of thiophene (0·85% sulphur) by treating for 4 hours with CO at 300° C. with MoS_2 as a catalyst, while under the same conditions the 175–200° C. fraction of a pressure distillate had its sulphur content reduced from 0·95 to 0·27%. G. R. N.

66.048.1 : 608.3

799. Patents on Refinery Plant. M. G. Paulus and A. E. Thompson. U.S.P. 2,039,979, 5.5.36. Improved shell type of still for the distillation of hydrocarbon oils.

66.048.3 : 608.3

D. K. Dean and E. N. Sieder. U.S.P. 2,040,431, 12.5.36. Vacuum fractionating apparatus.

66.048 : 608.3

E. C. D'Yarmett. U.S.P. 2,040,837, 19.5.36. Method of heat-treating liquids to recover lighter components as liquid products. W. S. E. C.

Cracking.

66.092

800. Recycle Stock for Cracking. L. A. Aleksandrov. *Azerb. Neft. Khoz.*, 1935, **5**, 87–91.—The low yields of gasoline observed in the Winkler–Koch and Jenkins units installed in Russia are due to a very mild cracking and the inability of the evaporators and the bubble towers to effect a better fractionation. It is proposed to raise the gasoline yield by vacuum distilling the residue obtained in the evaporator, followed by subjecting it to a mild cracking, returning it to the evaporator and passing it through the entire cycle in the Winkler–Koch unit. The vacuum distillation bottoms can be used in coking or asphalt stills where another 2–3% cracked gasoline may be obtained in addition to the other materials. A few more modifications permitting an increase in gasoline yield are described. For. Petr. Techn.

66.092 : 608.3

801. Patents on Cracking. Gyro Process Co. E.P. 445,549, 9.4.36. Improvements in the furnace of a cracking apparatus.

66.092.14 : 608.3

N. V. Nieuwe Octrooi Maat. E.P. 446,711, 5.5.36. Production of gasoline of low gum content. Hydrocarbon oil is first vaporized by heating above 950° F. and then admixed

with a heat-carrier above 950° F. The conversion products are then rectified under approximately 50–75 lb./sq. in.

66.092.12 : 668.3

J. L. Strevens and W. B. Mitford. E.P. 447,328, 13.5.36. Distillates obtained from the distillation of coal-oil in rotating cylindrical retorts are cracked in the liquid phase by heating to 400° C.

66.092 : 668.3

L. C. Huff. U.S.P. 2,039,797, 5.5.36. Cracking of hydrocarbon oils using two charging stocks, one a light gas oil, pressure distillate bottoms, etc., and the other, which may be any hydrocarbon oil from naphtha to fuel oil, is supplied to the fractionating system.

66.092 : 668.3

R. S. Petersen and C. W. Andrews. U.S.P. 2,039,835, 5.5.36. New method of coking hydrocarbons in which the charging stock is heated to remove lighter constituents before entering the coking unit.

66.092 : 668.3

A. C. Hampton. U.S.P. 2,040,048, 5.5.36. Cracking of hydrocarbon oil to produce gasoline and intermediate products, *e.g.* diesel fuel oil or furnace oil as by-products.

665.53 : 661.183.44 : 668.3

J. B. Hill. U.S.P. 2,039,904, 5.5.36. Refining of gasoline and kerosine, especially of naphthas, formed by cracking, by passing them through a chamber into which finely divided fuller's earth is introduced counter-current to the vapours.

66.092 : 668.3

E. W. Rembert. U.S.P. 2,039,981, 5.5.36. Cracking of hydrocarbon oils to increase the gas yield and to produce only small quantities of tars or fuel oils.

66.092 : 668.3

J. D. Seguy. U.S.P. 2,039,459, 5.5.36. Cracking of hydrocarbon oils in which the fixed gases are recombined with the residuals to increase the quantity of low-boiling gasoline.

66.092.8 : 668.3

A. L. Still. U.S.P. 2,039,611, 5.5.36. The carbon formed in cracking processes is precipitated and removed as a vapour powder.

66.092 : 668.3

A. G. Peterkin, Jr. U.S.P. 2,040,064, 5.5.36. Combined cracking and coking process in which the crude material is subjected to coking and the cycle condensate to cracking and distillation to form a fuel oil residue.

66.092.12 : 668.3

E. C. D'Yarmett. U.S.P. 2,040,838, 19.5.36. Combined vapour and liquid phase cracking in which the lean components of cracked oil are combined with gas rich in hydrogen to obtain to higher yield of saturated vapour and prevent deposition of free carbon.

W. S. E. C.

Hydrogenation.

66.094.17 : 668.3

802. Patents on Hydrogenation. H. E. Potts and Int. Hydrogen Patents Co., Ltd. E.P. 445,274, 30.3.36. Hydrogenation of carbonaceous substances under a pressure of 100 atm. or more in the presence of hydrogen halides or volatile halogen compounds. The apparatus is lined with silver or an alloy rich in silver so as to avoid corrosion in parts where the gases and vapours reach a temperature of 200–350° C.

66.094.173 : 668.3

F. Uhde. E.P. 445,688, 31.3.36. Process and apparatus for reducing metal-oxygen compounds, *e.g.* oxides, carbonates, nitrates, etc., of metals such as Cu, Sn, Zn, Cd, Fe, Co, Ni, etc.

66.094.1 : 608.3

H. E. Potts. E.P. 445,898, 21.4.36. Separation of solid products in hydrogenation processes by adding up to 20% of an aliphatic hydrocarbon rich in hydrogen, and boiling below 50° C., *e.g.* liquefied butane.

66.094.1 : 608.3

E. I. Du Pont de Nemour & Co. E.P. 446,013, 22.4.36. Hydrogenated derivatives of hydrocarbons, *e.g.* dihydronaphthalene and its homologues or polymers, are prepared by allowing sodium to react with acenaphthene, naphthalene or their homologues in the presence of active ether as solvent; the reaction product is then hydrolysed.

66.094.17 : 608.3

H. E. Potts. E.P. 446,114, 24.4.36. Hydrogenation of carbonaceous substances to produce liquid hydrocarbons using as catalyst germanium or its compounds. The catalyst is first mixed with a sulphur compound, *e.g.* carbon disulphide, sodium sulphide, etc., before application.

66.094.17 : 608.3

I. Seto and M. Sato. E.P. 447,159, 13.5.36. Hydrogenation of liquid organic compounds, *e.g.* oils, nitrobenzene, etc., using a powder catalyst. During the reaction a high tension alternating current is passed through the mixture to promote the velocity of the reaction and a direct current is applied after the reaction to keep the catalyst in the reaction chamber.

66.094.17 : 608.3

J. Y. Johnson. E.P. 447,210, 14.5.36. Hydrogenation of carbonaceous substances in the presence of corrosive halogens using as catalyst, sodium sulphite or sulphate or alkaline-earth metals or zinc.

66.094.1 : 608.3

T. W. Pfirrmann. U.S.P. 2,041,858, 26.5.36. Hydrogenation of carbonaceous materials at 400–500° C. and under a pressure above 100 atm., using nascent hydrogen developed in the reaction mixture by the interaction of spongy iron and water in the presence of a dilute aqueous solution of magnesium chloride containing nickel chloride.

66.094.17 : 608.3

R. T. Haslam. U.S.P. 2,042,306, 26.5.36. Manufacture of highly unsaturated or aromatic distillates from heavier oils, *e.g.* gas oils using as catalysts molybdenum or tungsten sulphide, tellurides or selenides of chromium, molybdenum and tungsten, at 930° F. and at pressures above 20 atm. W. S. E. C.

Polymerization.

66.095.26 : 665.511

903. Polymerization is Applicable to Natural Gas only in Concentrated Gas Areas. A. L. Foster. *Nat. Petr. News*, 22.4.36, **28** (17), 43.—The feasibility of erecting plants for the production of polymer gasoline from natural gas in the various producing fields of U.S.A. is discussed. Arguments based on the desiderata of the minimum economical size of the plant, its initial cost, maintenance, amortization, and operation costs, are naturally somewhat hypothetical. The whole process is still, relatively, in the experimental stage, but it appears certain that capital charges are very high. The value of natural gas as a source of polymer gasoline depends on its propane and butane content, principally the latter, and this fact alone automatically limits the number of fields in which polymerization could be profitably carried out. A further very important consideration is the cost of the collection of the gas and its concentration by a pipe-line system at a central plant. The cost of such collection can be determined accurately, and again the cost is high. Also the cost of the raw gas depends, to some extent, on the degree to which it, at present, finds other profitable outlets. In districts where the concentration of butane in the gas is relatively low, or the total amount is relatively small, its equivalent cost may be uneconomically high to the prospective operator of a polymerization plant. These and other considerations are discussed at length and with reference to several projected schemes, and the con-

clusion is reached that at present the Panhandle field of Texas and the East Texas fields are the ones most favourable for exploitation. H. G.

66.095.26 : 665.521.1

804. Polymerization of Petroleum Gases. Anon. *Petr. Times*, 1936, **35**, 533.—The production of gasoline from natural gas and waste refinery gases is reviewed from theoretical first principles, and the principal commercial processes of polymerization are discussed in general terms. The processes are classified in three types: (*a*) Simple polymerization processes involving unsaturated hydrocarbons such as ethylene and propylene; (*b*) Two-stage processes in which the unsaturated bodies are produced by the dehydrogenation of saturated hydrocarbons; and (*c*) Catalytic processes in which the polymerization of unsaturated bodies is carried out in the presence of a catalyst. When operating on, for instance, Gyro vapour-phase gases containing, approximately, 50% unsaturateds, the gas is heated at a temperature of 900–1000° F. and 800 lb. per square inch pressure, and yields 3·7 gallons 420° F. end-point gasoline per 1000 cu. ft. gas treated. The unchanged gas is recycled with the normal feed. If the changing stock is first stabilized by the elimination of hydrocarbons below propylene, the yield is increased to 8·8 gallons per 1000 cu. ft. of stabilized feed. In a typical two-stage process propane and butane may be cracked at a temperature of 1035° F. and 1200 lb. pressure, and the treated gases recycled through a relatively cooler part of the same furnace to yield a 97–456° F. polymer. This polymer, on fractionation, yields a 112–379° F. gasoline of 93 octane rating. A plant using the catalytic process operates on cracking plant gases containing 27% wt. olefins which are available at 175–200 lb. pressure. They are heated to 400° F. and passed through a series of three or four towers containing phosphoric acid as the catalyst. The yield of gasoline of 10 lb. Reid Vapour Pressure is 5·2 gallons per 1000 cu. ft. gas. The octane rating of the gasoline is 81 and its blending octane rating is 115. In the preparation of *iso*-octane, *iso*butylene is prepared by the fractionation of compressed vapour-phase gases which contain a considerable quantity of that body. *iso*Butylene is then catalytically polymerized to di*iso*butylene, which, in turn, is hydrogenated to *iso*-octane. The production of polymer gasoline has been proved definitely to be commercially feasible, and its future appears to rest on the outcome of research into the many problems which the processes present and the trend of market prices. H. G.

66.095.26 : 547.313.3

805. Propylene Polymerization. V. N. Ipatieff and H. Pines. *Ind. Eng. Chem.*, 1936, **28**, 684.—This paper records the results obtained during the polymerization of propylene either in the presence or absence of phosphoric acid at temperatures ranging from 330° to 370° C. and under high pressures. The liquid products obtained from the catalytic reaction (*i.e.* in presence of phosphoric acid) consisted of paraffins, olefines, *cyclo*-olefines, *cyclo*paraffins and aromatics, the last-named being present in small quantities in the high-boiling fractions of the reaction product. Thermal polymerization (*i.e.* in absence of phosphoric acid) yielded a reaction product which did not contain aromatic hydrocarbons. High-temperature–pressure catalytic polymerization of propylene differs greatly from the low-temperature–pressure polymerization previously recorded; the latter yielding a liquid product consisting mainly of open-chain olefinic hydrocarbons. The catalytic polymerization of propylene proceeds much faster than thermal polymerization, and the distribution and percentage of the various hydrocarbons formed differ greatly in the two cases. Thermal polymerization yielded about 66% of cyclic hydrocarbons (*cyclo*paraffins and *cyclo*-olefines), whereas catalytic polymerization only yielded about 22% of cyclic hydrocarbons. Further, the degree of unsaturation of the product obtained by catalytic polymerization was much greater than that obtained by the thermal process.

The authors propose to call polymerization where different types of hydrocarbons are formed "conjunct polymerization," in order to differentiate it from ordinary polymerization. H. E. T.

66.095.26 : 608.3

806. Patents on Polymerization. J. Y. Johnson. E.P. 445,358, 8.4.36. An apparatus and method are described for the production of polymerization products of acetylene.

Gases containing 20% by volume of acetylene are passed into an acid cuprous salt solution at such a low temperature and velocity that the gas escaping from the solution is free from polymerization products of acetylene. The cuprous salt solution is continuously withdrawn from the absorption plant and introduced into a regenerating plant. The polymerization products are separated from the gas mixture escaping from the regenerating plant.

66.095.26 : 608.3

J. C. Morrell. U.S.P. 2,039,440, 5.5.36. Treatment of olefinic gases in the absence of substantial quantities of normally condensible hydrocarbon vapours to polymerize gaseous olefine hydrocarbons into liquid hydrocarbons, with zinc chloride solution in the presence of added hydrogen chloride.

66.095.26 : 608.3

J. C. Morrell. U.S.P. 2,039,441, 5.5.36. Treatment of olefinic gases as described above at such temperatures and pressures that the zinc chloride is maintained in aqueous solution during the polymerization.

66.095.26 : 608.3

W. E. Kuentzel and T. A. Geissman. U.S.P. 2,040,658, 12.5.36. Polymerization of unsaturated normally gaseous hydrocarbons, to produce liquid hydrocarbons using an aluminium halide double salt as catalyst. The latter is mounted on an inert desiccative material, and the gases are passed successively through a drying stage and a catalyst stage using, respectively, exhausted and active aluminium halide double salt.

W. S. E. C.

Motor Fuels.

621.019.8

807. Effect of Sulphur Compounds on Lead Response. S. F. Birch and R. Stansfield. *Ind. Eng. Chem.*, 1936, **28**, 668.—The work recorded in this paper was undertaken in order to account for the observations of Hebl, Rendel and Garton (*Ind. Eng. Chem.*, 1933, **25**, 191). Small quantities of various types of sulphur compounds were added to a synthetic fuel consisting of 65 parts 2 : 2 : 4-trimethylpentane (*iso*-octane) and 35 parts *n*-heptane; the knock-rating of these blends alone, and after addition of definite quantities of tetraethyl lead, was determined, the standard C.F.R. engine and motor method of operation being employed. The quantity of sulphur compound added was such as to make the sulphur content of each blend 0·1%; in this way a comparison of the effect of sulphur combined in various ways was obtained. The effect on the lead response for the sulphur compounds used increased in the following order: thiophene, sulphide, mercaptan, disulphide, trisulphide and thioglycol. Ethyl trisulphide and the mercaptans were definitely proknock, whilst the sulphides produced no measurable effect. The sulphides all produced the same drop in response for a constant sulphur content, the molecular weight of the group attached to the sulphur atom having little effect. None of the above sulphur compounds produced an effect resembling that observed by Hebl, Rendel and Garton.

The effect on the lead response of plumbite treatment of a solution of ethyl mercaptan in heptane–octane blend was next investigated. In order to determine the effect of the basic fuel, blends of *n*-heptane with other hydrocarbons possessing anti-knock properties were made and tested in a similar way; and for purposes of comparison these blends were made with an octane number as near as possible to 65. Of these blends, that containing *cyclo*hexene and *n*-heptane gave a peculiar lead response, and it is thought that this can be attributed to the fact that *cyclo*hexene forms peroxides with extraordinary ease. From the blends of *n*-heptane with olefines, and diolefines, results were obtained which throw some light on the poor response shown by certain gasolines containing cracked spirit.

Further work was carried out on a few straight-run and cracked gasolines.

H. E. T.

662.753.24

808. Refining of Lignite Spirits. B. Kwal. *Chim. et Ind.*, 1936, **35**, 1040.—Crude lignite spirits are not suitable as motor fuels owing to their high content of diolefines, which form gum on storage by a mechanism involving oxidation. Ozone accelerates

this polymerization, but a mechanism involving intermediate formation of peroxides is prefered to one in which ozonides play a like part. Phenylhydrazine acts as oxidation inhibitor, but fails to prevent a sudden colour deterioration that sometimes takes place on storage, and now believed to be due to electric discharge. Thus spirit exposed to a thunderstorm was found to be markedly altered.

In refining the spirit, diolefines, sulphur compounds and acids must be removed. The sulphur compounds present consist of mercaptans, disulphides, sulphides and thiophens as well as elementary sulphur. Sulphuric acid oxidizes hydrogen sulphide to sulphur and sulphur dioxide, dissolves sulphides and disulphides, and gives sulphonic acids with thiophen. Hydrogen peroxide oxidizes hydrogen sulphide to sulphur dioxide only, and, under certain conditions, thiophen to thiophenic acids, which can be removed with caustic soda. This reagent is preferred to sulphuric acid owing to the wasteful losses produced by the latter and the following refining scheme is proposed. A wash with hydrogen peroxide solution is followed by a treatment with "Carbonit" earth and hydrogen peroxide. Then washes with water and alkali, followed by a Doctor treatment to remove mercaptans and elementary sulphur and a final water-wash yield a water-white spirit, which has a high anti-knock value and a pleasant odour and which does not deteriorate on storage. E. G. H.

662.754.2

809. 10,000-Gallon Alkyl Gas Plant. A. L. Foster. *Nat. Petr. News*, 1.4.36, **28** (14), 99.—The construction of a plant to produce 10,000 gallons per day of alcohol for motor fuel has been commenced in Kansas. The raw material is local corn, potatoes or artichokes. It is claimed that a new yeast culture has been produced which will provide a "10%" mash in 72 hours. Older fermentation methods yield 2·3% mashes in 90 or more hours. The plant comprises five stills, four for the continuous stripping of mash and one "dehydrator," which it is claimed will produce alcohol of 99·8% strength. The spent mash will be dried and used as cattle feed. The price of the alcohol, as distributed to blenders, is 25 cents/gallon F.O.B. works, and it will not be subject to the State motor-fuel tax. The plant, it is claimed, will be responsible for the employment of 4000–5000 people, and is sponsored solely as an aid to the agricultural community. H. G.

662.758.2

810. Miscibility of Alcohol and Oils. T. I. Taylor, L. Larson, and W. Johnson. *Ind. Eng. Chem.*, 1936, **28**, 616.—Data are given for 17 oils of animal and vegetable origin in mixture with absolute and 90% alcohol, together with the amounts of oleic acid necessary in each case to cause complete miscibility. The volumes chosen for the miscibility tests were, in every case, oil–alcohol ratios of 1 to 2, 1 to 1, and 2 to 1, and the compositions of the oil and alcohol phases for mixtures in these ratios are given. On adding increasing amounts of oleic acid to any of the mixtures, the volume of the alcohol phase decreased, and finally disappeared, giving complete miscibility.

The extent of the miscibility of alcohol and the oils is stated to be characteristic for each oil. Acid value is important, but is not the determining factor. High acid values increase the miscibility, and also markedly increase the stability of the emulsions produced during mixing. The influence of small amounts of water on the miscibility of alcohol and oils is shown to be appreciable. F. E. A. T.

665.521.2 : 66.094.54

811. Continuous Acid Treatment of Cracked Distillates. J. S. Walton. *Refiner*, 1936, **15**, 94, 160.—The sulphur content of a cracked distillate is reduced in sulphuric acid treatment by preferential solution of sulphur compounds in and by a polymerizing reaction with the acid. The use of more than 12–18 lb. per brl. is regarded as uneconomic except for gasolines of exceptionally high sulphur content. The use of inhibitors minimizes the degree of refining, but at present does not entirely eliminate this step. The process of acid treatment may be conveniently divided into contacting, sludge removal and neutralization plus settling. The batch method of contacting with air agitation has been discarded in favour of cheaper, more efficient and safer continuous methods. Acid of 59° Bé. is strong enough for continuous treatment of most cracked distillates, and the recovery of acid from the sludge is not worth while

in refineries of capacity less than 35,000 brl. daily. Providing the treating temperature is held below a certain limit, characteristic for each stock, and the mixing is efficient, the longer the time of contact the better the quality of the treated stock and the less acid will be required. If sludge is allowed to accumulate and rise in temperature, then undesirable sulphonation reactions will occur. Pepper sludge in the oil does little or no harm if the temperature is low. Minimum contact times may vary for 10 seconds to 1 minute. Methods for mixing should aim at intimate contact without high dispersion, using a liberal amount of acid, and systems of jets or injectors are considered the most satisfactory in this respect. Acid is best added in aliquot portions rather than all at once. The important advantages of counter-current treatment with sludge re-circulation are:

(1) The most reactive constituents are removed by the weakest acid, the least reactive of the unstable constituents by the strongest acid;
(2) The acid is used to its maximum extent, and
(3) The most reactive constituents are retained in the acid layer. Usually a single sludge stage is sufficient. For transference and mixing of sludge and acid ejectors are preferable to pumps.

By means of Stokes' law the design of the sludge settler can be calculated for any degree of settling. A horizontal settler is more efficient than a vertical settler in that the last particles to be settled are smaller. Baffles should be used to ensure maximum travel of oil. Percolation filters will remove acid, and while fuller's earth is very efficient, it is expensive; by mere mechanical action a sand filter will reduce the acidity in an oil by 400%, thus reducing the subsequent soda treat. Centrifuges are being increasingly adopted, since their use connotes lower caustic costs, better quality of distillate and reduced corrosion and cleaning of re-run units. In neutralization the main effect of the water wash is to reduce the cost of the subsequent soda wash, and its adoption will depend on the price of the soda. It is suggested that it would be profitable to investigate the neutralization stage of the treatment further, *e.g.* ascertain the preferential solubilities in caustic soda of esters sulphonates, etc., and also the relative efficiencies of caustic soda, caustic potash, calcium hydroxide, etc. At the present time the formation of emulsions in the caustic settlers is a rare occurrence, but nevertheless it is advisable to pass the neutralized oil through a sand filter or settle it in large tanks before it is charged to the re-run unit. G. R. N.

665.542

812. Chemical Processes in the Refining of Petroleum Distillates. J. C. Morrell, G. Egloff. *Nat. Petr. News*, 8.4.36, **28** (15), 24 L; 15.4.36, **28** (16), 37.—In the Gray process for refining gasoline distillates the gasoline fraction is separated from a vaporized cracked distillate, and while still in the vapour phase is contacted with 30–60 mesh fuller's earth, which has the property of selectively polymerizing the objectionable hydrocarbons. The treated vapours and polymers formed are removed separately and continuously from the clay. The process is usually operated for the purpose of obtaining gum and colour stability. Yields of treated gasoline per ton of clay vary from 1500 to 10,000 brl., according to the temperature and pressure maintained on the contacting towers. Yields are increased by an increase in temperature and pressure independently. In a variant of the process a slurry of clay in the overhead condensate is passed downwards counter stream to the gasoline vapours to be treated. In a further variant the gasoline is heated to the appropriate temperature and passed in the liquid phase and under pressure through the clay. In the Day process the stabilized distillate is passed direct from the cracking unit to the bottom of a treating tower packed with brass, where it meets dilute aqueous HCl. Acid in the treated gasoline is neutralized with ammonia and washed with water. Colour stable products of low gum content are claimed to be obtained. The process has considerable application in desulphurizing high sulphur distillates when followed by a light acid treatment. Zinc chloride is the active agent in the Lachman process. Gasoline vapours are washed with a 50% aqueous solution of $ZnCl_2$, passed through a limestone packed tower to neutralize acid bodies, and then fractionally condensed. The $ZnCl_2$ is stated to be 99% recoverable, while polymerization losses are 1–3%. In the sweetening of gasolines to remove H_2S and mercaptans, sodium Plumbite is the usual reagent. This body reacts with mercaptans to form lead

mercaptides, which in turn reacts with elementary S, either present already or added, to form lead sulphide and the disulphides of the mercaptans. It has been shown that there are intermediate reactions in which basic mercaptides are formed. These break down to form lead sulphide and alcohols. Sodium hydrochlorite, as a sweetening agent, is satisfactory for straight-run or natural gasolines, but when applied to cracked distillates the product is neither gum nor colour stable. By this treatment organic sulphides are quantitatively oxidized to sulphones and disulphides to sulphonic and sulphuric acids. Neither thiophene nor elementary S is affected. Increase in the molecular weight of the S compound decreases the rate of oxidation and decreases the solubility of the oxidation products, which become increasingly soluble in the oil layer. Brucite, an hydrated magnesium oxide, functions much as sodium plumbite does, and is claimed to be useful also for the removal of phenols, H_2S and acid bodies. It is stated that gasoline may be sweetened at the rate of 1250 brl. per ton of Brucite before revivication is necessary by treating with 5° Bé. NaOH, washing and drying. Many processes use cupric chloride as the sweetening agent. This material reacts with mercaptans to form the dialkyl disulphide, cuprous mercaptide and HCl. In a variant of this process ammonium chloride and copper sulphate are deposited on granular fuller's earth, which is then used as a contacting reagent by downward percolation. Copper salts are claimed to be superior to those reagents which include elementary S, which is detrimental to colour and gum stability. The articles end on a note suggesting that many refining processes are not really necessary, since they have no great effect on the utility of a motor fuel as such. It is suggested that in many cases the desired end could be quite well encompassed by the discreet use of substances which will mask undesirable colour and odour. H. G.

665.581.5

813. Production of Petrol by the Hydrogenation of Bituminous Coal. Part I. F. E. Smith. *Engineer*, 1936, **161**, 619.—This paper opens with a review of previous work carried out on the hydrogenation of coal and oil; but its main purpose is to describe the plant erected at Billingham by the Imperial Chemical Industry for the hydrogenation of bituminous coal.

In this process the only final product of importance is petrol, there being no other major products whose disposal might present difficulty. The small amount of solid residue (about 5%) is burnt under the boilers; the butane fraction of the gas is separated and bottled for various uses, and the remainder is used principally for heating purposes. The nitrogen present in the coal appears as ammonia, and is used to produce ammonium sulphate; the sulphur, liberated as sulphuretted hydrogen, is employed in the manufacture of sulphuric acid in conjunction with the existing process.

One ton of coal will yield more than 0·6 ton of petrol, equivalent to 180 gallons of petrol (19,080 B.Th.U.'s per lb. net); but to provide the hydrogen, heat energy, steam and electrical power required, approximately 5 tons of raw coal are required to produce 1 ton of petrol. The hydrogen used in this plant is obtained from water-gas; but improved methods of hydrogen production at present under investigation may result in improved yields of petrol. Should it be necessary, for economic and other reasons, the process may easily be adapted for the production of large quantities of fuel-oil in place of petrol; a light diesel oil could also be produced from the middle oil produced in an intermediate stage of the process.

The production of purified and compressed hydrogen for the hydrogenation plant is now described. The supply of hydrogen is obtained from steam and coke by the water-gas reaction

$C + H_2O \longrightarrow CO + H_2 - 51{,}912$ (B.Th.U. and lb. molecules). The coke oven installation, comprising 64 ovens each of 13·5 tons capacity, serves both the ammonia and hydrogenation sections. All the gas made is treated for the removal of H_2S by the well-known bog-iron ore process, which is described in detail. From the sulphur-removal plant the gases pass to the hydrogen plant, where they undergo a high-temperature catalytic process for the conversion of the carbon monoxide into hydrogen at the expense of steam. The gas is now compressed to 825 lb./sq. inch in stages, and then any carbon dioxide is removed by water-scrubbing in packed towers; the gas is now finally compressed to 3750 lb./sq. inch. After this final compression the gas is purified by scrubbing with a special solution of cuprous ammonium salts, from

which it passes to the hydrogenation plant. A description of the actual hydrogenation plant now follows in some detail. The plant consists of five units for liquid and vapour-phase working; a diagram showing the general layout of the converters, interchangers and catch pots for a unit hydrogenating coal in the liquid phase is given. Clean coal mixed with an equal weight of oil, previously made by the process, is ground in rod mills to a fine paste, and the necessary quantity of catalyst is added. This paste, after mixing with the high-pressure hydrogen, is heated by interchange with part of the products from the reaction, and finally in preheaters before entering the reaction zone in the converters. The "overhead products" from the liquid-phase hydrogenation stage consist of unabsorbed hydrogen, hydrocarbon gases, petrol, middle and heavy oils and are separated from the solid matter in a hot catch-pot. After interchanging their heat with the incoming products, they are cooled and further separated into gaseous and liquid products in the cold catch-pot. The oils are distilled for separation of the various fractions and the middle oil is further hydrogenated in the vapour phase. The heavy oil is recirculated for making into a paste with fresh coal, and the petrol produced is ready for distribution after a simple refining treatment. The petrol produced is remarkably free from unsaturated and gum-forming compounds; all the petrol receives a soda wash to remove H_2S the vapour-phase petrol being then ready for export; the liquid-phase petrol, however, is washed with sulphuric acid and then soda and is finally re-run in a steam-heated still. H. E. T.

665.581.5

814. The Problem of Synthetic Fuels. Fr. Schwers. *Rev. Comb. Liq.*, 1936, 45–48.—The author criticizes some comments made by Dr. Helmut Klotz in an article which has appeared in *Revue de l'Armée de l'Air*, his main point being that the actual cost of producing synthetic fuels by hydrogenation of coal under pressure or by the chemical conversion at atmospheric pressure of water gas, is not lower in Germany than in other countries where similar conditions exist, *i.e.* large coal-fields in close proximity to industrial centres.

The following three possibilities are discussed:

(1) The hydrogenation of natural mineral oils,

(2) The hydrogenation of various types of heavy oils produced by the carbonization of solid fuels, and

(3) The direct liquefaction of coals and lignites,

and it is pointed out that the hydrogenation of heavy petroleum derivatives under high pressures is already a close second to cracking, since the yields, stability of products, etc., are considered in many cases to warrant the high cost of hydrogen and maintenance of plant. Reference is made to an article published in *L'Industrie Chimique*, September, 1935, by H. M. Stemart dealing with this matter.

Dealing with the heavy oils produced from coals, lignites and shales, it is stated that hydrogenation is particularly attractive, especially as these oils contain "phenols," and possible yields of about 90% can be obtained as against about 30% with cracking. The author states that the direct liquefaction of coals or lignites can be economically justified only when the natural supplies of petroleum have become exhausted, and that Germany produces synthetic gasolines by this means which work out at least five times the cost of the natural product, the author's conclusion in this case being that it is obvious that the German policy in this case is being dictated entirely by its War Office, and not by any economic requirements.

It is of interest to note, however, that in spite of the claims put forward by Germany on the success of the direct liquefaction process, the fuel policy of that country is slowly turning towards the hydrogenation of heavy oils, as evidenced by the recent information received from the "Hydrierwerke A.-G.," who are putting up near Leipzig a carbonization works for the treatment of 5000 tons per day of dried lignite with the subsequent hydrogenation under pressure of the 200 tonnes of tar which it is hoped to produce from the carbonization.

It is pointed out that the I.C.I. in England is working on a programme of hydrogenation of high- and particularly low-temperature coal tars, and not directly on coals, and that in France the coal production is not sufficient for the consumption, and that therefore direct liquefaction should not be put into operation.

Dealing with the Fisher process as against hydrogenation at high pressures (at

least 200 kg./cm.^{2}), the author is of the opinion that this process comes within the category of "war processes," and that in the near future semi-heavy hydrocarbons such as gas-oils will become at least as important as gasolines, and would serve as basic materials for the production of synthetic fuels by hydrogenation.

The author concludes with the statement that it is of importance that hydrogenation in France should come within the category of normal peace-time industries, which can quite easily be done provided the public authorities are willing to give it the normal moderate protection which it is their duty to give to all new industries. M. M. L.

621.43.01 : 621.43.067

815. An Index of the Air/Fuel Ratio Found in Exhaust Gas Analysis. Anon. *Nat. Pet. News*, 19.2.36, **28** (8), 30.—It is stated that the determination of one of the essential constituents of the exhaust from an I.C. engine running under normal conditions suffices for a calculation of the air/fuel ratio. A chart has been prepared which connects the two factors. The data from which this chart was constructed were derived from experiments conducted on three engines. It was assumed that the fuel contained 84·9% C and 15·1% H_2 and that the relation between the constituents in the gas is such that $\frac{CO \times H_2O}{CO_2 \times H_2} = 3{\cdot}8$. It was assumed further that 1·875% of C in the fuel appears as CH_4 in the exhaust, and that there is no selective combustion of any constituent of the fuel in the engine. H. G.

665.582.2

816. Germany's Synthetic Motor Fuel Production. Anon. *Petr. Times*, 1936, **35**, 643.—Efforts to make Germany independent of imported motor fuels and lubricants continue with unabated vigour, but marked efforts are being made to put the industry on a relatively sounder economic basis. Effort is being concentrated on the use of lignite as the raw material, and the production of unorthodox fuels is being somewhat discouraged. Three methods of treating lignite are in use: (*a*) Carbonization (Schwelen); (*b*) Hydrogenation; and (*c*) Gasification. The first process is the oldest established, and the capacity of existing plants operating on that process can be increased now that the problem of the disposal of the coke has been solved. The catalytic hydrogenation of lignite tars and of lignite itself is being developed mainly for the production of motor spirit, but the process can be adapted for the production of gas-oil, fuel-oil and lubricating oil. The last process, (*c*), offers the best prospect for the production of these heavier materials. In it, the Fischer–Tropsch synthesis gas (water-gas) can be converted, in the presence of catalysts and at ordinary pressure and a temperature of 200° C., into motor spirit, diesel oil, liquid gases, and paraffin wax. The plant operating this process has the further advantage of being small, and plants can, therefore, be erected all over the country. The ratio of the costs of imported to home-produced motor spirit has been put at 7/25, but such a disparity will cease to be a deterrent while "foreign exchange" difficulties and the war menace remain. H. G.

665.521.23 : 608.3

817. Patents on Motor Spirit. Standard Oil Development Co. and C. Arnold. E.P. 445,503, 14.4.36. Manufacture of non-knocking motor fuel for internal-combustion engines by blending gasoline with *iso*propyl ether in an amount constituting 30% by wt. of the fuel.

66.097.38 : 608.3

H. W. F. Gifford. E.P. 445,727, 17.4.36. Catalysts used for converting mineral oils into oils of lower b. pt., *e.g.* bauxite, are revivified by boiling them with water, removing the oil, decanting the aqueous extract and recalcining the wet residue of bauxite at red heat.

66.097.38 : 608.3

H. W. F. Gifford. E.P. 445,757, 17.4.36. Catalyst used as described in E.P. 445,727 and impregnated with an aqueous solution of a crystalline chloride of aluminium, zinc and/or magnesium as carrier, and evaporating to dryness. The catalyst

is revivified by boiling the spent catalyst with water, removing the separated oil, decanting the aqueous extract and calcining the carrier. The latter is reimpregnated with the extract, adding if necessary a small quantity of hydrochloric acid and of the appropriate metal chloride solution. The mixture is then evaporated to dryness.

662.758.2 : 608.3

Ruhrchemie A.G. E.P. 446,493, 27.4.36; cf. abstr. 704. Production of gaseous fuel mixtures comprising 30–50% by volume or less than 20% by volume of ethane, ethylene and other gases, *e.g.* butane, propane, butylene in suitable relative proportions and containing 3% of hydrogen, methane, carbon monoxide, etc.

665.521.23 : 608.3

Bataafsche Petroleum Mij. E.P. 446,621, 4.5.36. Production of high anti-knock benzene from low anti-knock benzene by subjecting benzenes in the vapour phase under ordinary or slightly raised pressures and at temperatures at which practically no hydrocarbons gaseous at ordinary temperature are formed. Phosphates of alkaline-earth metals are used as catalysts.

665.521.23 : 608.3

J. C. Geniesse and R. Reuter. U.S.P. 2,039,894, 5.5.36. Production of gasoline of high anti-knock gasoline by heating crude petroleum to vaporize naphtha and separating first the vaporized portion. The higher-boiling portion of naphtha is then heated above 850° F. to cause thermal conversion of the hydrocarbons. The gasoline is then separated.

66.094.52 : 608.3

G. Egloff and J. C. Morrell. U.S.P. 2,040,366, 12.5.36. Refining of motor fuel by subjecting the oil in the vapour form to the action of sulphur trioxide and steam in the presence of finely divided zinc sulphate and fuller's earth.

66.094.57 : 608.3

W. Miller. U.S.P. 2,041,364, 19.5.36. Removal of corrosive mercaptans from cracked hydrocarbons by contacting the hydrocarbons with an absorption medium, distilling the adsorbed hydrocarbons and sulphur compounds from the medium and fractionating the gases and vapours to remove sulphuretted hydrogen and lighter hydrocarbons. The heavier hydrocarbons containing heavier sulphur compounds are subjected to sweetening and then stabilized.

66.094.54 : 608.3

W. W. Gary. U.S.P. 2,041,754, 26.5.36. Refining of cracked gasoline by means of sulphuric acid to remove gum and sulphur constituents and to improve the colour.

662.753.12 : 608.3

A. Reis. U.S.P. 2,041,957, 26.5.36. Production of liquid fuels from pitch, tar, acid sludge, etc., by mixing them with water and chalk to neutralize, removing the excess water and mixing the neutralized material with oil. The mixture is then passed rapidly down through a zone heated by radiation to a temperature equivalent to red heat to cause evaporation, and the vapours are then cracked.

66.094.57 : 608.3

C. O. Hoover. U.S.P. 2,042,050, 26.5.36. Removal of sulphur compounds from light distillates (motor spirit, kerosene), which have been previously treated to remove water, by adding gaseous oxygen to the sour oil and contacting with an agent which forms mercaptides with the sour constituents of the oil, removing the mercaptides by means of an adsorbent material.

66.094.57 : 608.3

C. O. Hoover. U.S.P. 2,042,051, 2,042,053, 26.5.36. Process as described in U.S.P. 2,042,050, the adsorbent material containing cuprous chloride.

66.094.57 : 668.3

C. O. Hoover. U.S.P. 2,042,052, 26.5.36. Process as described in U.S.P. 2,042,050, the adsorbent material containing a solid salt from the group consisting of mercurous, cuprous, cobaltous or cadmium chloride.

66.094.57 : 668.3

C. O. Hoover. U.S.P. 2,042,054, 26.5.36. Process as described in U.S.P. 2,042,050, the hydrocarbon oil sweetened by contacting with adsorbent material containing cupric chloride in the presence of alkali potassium permanganate.

66.094.57 : 668.3

C. O. Hoover. U.S.P. 2,042,055, 26.5.36. Sweetening sour mineral oils by treatment with an aqueous solution of a metal compound forming mercaptides with the sour constituents, and then contacting the oils with an adsorbent material in the presence of added oxygen.

66.094.57 : 668.3

O. Codier. U.S.P. 2,042,056, 26.5.36. Sweetening of sour hydrocarbon oil by contacting with plumbite solution to form lead mercaptide. The treated oil is then contacted with an adsorbent material, and then with caustic soda solution in the presence of oxygen and the lead mercaptide. The plumbite solution is then recovered and used again.

66.094.57 : 668.3

G. H. B. Davis. U.S.P. 2,042,298, 26.5.36. Refining and desulphurizing of natural or cracked gasoline by passing it together with a large excess of free hydrogen, through a catalytic zone containing a sulphur-resistant hydrogenating catalyst at 800–850° F. and at superatmospheric pressure. W. S. E. C.

Kerosine.

66.094.5 : 668.3

818. Sulphonation of Kerosine. K. Likhushin, S. Shkhiyan and N. Levkopulo. *Azerb. Neft. Khoz.*, 1935, **6**, 75–79.—The sulphonation of kerosine with H_2SO_4 is carried out with greater ease than that of gas-oils and other oil fractions. The obtained product is easily separated with NaCl. This method permits a 25% recovery of the oil carried off during the process. These oils can be used as additions to tractor kerosines, thus improving their anti-knock properties. The acid recovered from this treatment has a strength of 60–65%. For. Petr. Techn.

Lubricants and Lubrication.

66.061

819. Natural Gas Fractionation of Petroleum by Pilat's Method. M. Naphtali. *Refiner*, 1936, **15**, 116–119.—Describes the original work of Kling on the precipitates obtained by the addition of very light gasolines to Polish petroleum, and the later experiments of Pilat and his co-workers on the use of natural gas and its constituents as a selective solvent in precipitating asphalt and other high-molecular-weight compounds from petroleum. Tables are given of the cold fractionation of residues of Rumanian, Venezuelan and Harklowa crudes. The latter are dissolved in 4–5 vols. propane-butane mixture at 8 atm. pressure in a pressure bottle, then dry natural gas (97% methane) is pumped in until the pressure is 30 atm., when the first precipitated fraction is removed. Other fractions are taken off for every increase of 10 atm. up to a final pressure of 130 atm. The viscosity index increases from fraction to fraction, while the specific gravity and pour point decrease. The experiments indicate that in cold fractionation three principal fractions are precipitated, asphaltic matter (up to 8 atm.), colour constituents (around 40 atm.) and lubricating oil. The article is concluded with a short discussion of the work of other investigators of this type of process. Eleven references. G. R. N.

66.067.1

820. A Problem of Contact Filtration. K. V. Kostrin and others. *Azerb. Neft. Khoz.*, 1935, **6**, 72–74.—Contrary to the prevailing opinion it is stated that clay is not the only neutralizing agent in the contact filtration of acid-treated lubricating oil. The neutralization also takes place through the elevated temperature, which causes the evaporation of part of the acid as well as the decomposition of H_2SO_4 to SO_3 and SO_2, which is evaporated during the treatment or carried off by the stream of air or steam. Therefore it is essential for vapour discharge tubes of the treating equipment to be constructed of cast iron, and to be as short as possible to avoid condensation of acid vapours. For. Petr. Techn.

621.891

821. Metallic Wear in the Presence of Lubricants. H. W. Brownsdon. *Engineering*, 1936, **141**, 310–311.—This paper describes experiments made with a rotating hardened steel wheel with the periphery radiused. This rubs against a flat metal plate clamped to a table through which the load is applied. Oval areas of wear are produced. The metal is flooded with lubricant and the test temperature was about 68° F. Wear is reduced by thicker oils, whilst castor oil is claimed to be better for minimizing wear than the thickest mineral oil. This claim was substantiated by measuring the electrical resistance of the film of oil between the metal surfaces.

The value of a lubricant as a preventive of wear varied with the nature of the metal or alloy, and might vary considerably with the conditions of test, such as smoothness of finish, load, etc. It is concluded that wear is the resultant of so many variables that unless these were very closely defined, conclusions reached from experimental work might easily be misleading. J. L. T.

621.892.096 : 532.13

822. Viscosity of Cylinder Oils. G. Duffing. *Oel u. Kohle*, 1936, **12**, 420.—Measurement by means of a special apparatus (DRP 575,988) have shown that at working temperatures (250–300° C.) cylinder oils are about ten times as viscous as water at corresponding temperatures (extrapolated from Vogel's formula). Results on nine oils over the range 100–300° C. are tabulated. P. G. H.

621.892.25

823. Manufacture of Grease. Parts III and IV. W. Maas. *Öle, Fette, Wachse, Seife, Kosmetik*, 1936, March, 9–12; April, 21–27.—*Manufacture of Greases by Autoclaves.* This is the most satisfactory manufacturing method, as saponification takes place quickly and completely. Latterly it has become standard practice.

Generally the autoclave is used only for the actual saponification, the grease being finished in an open steam-heated kettle.

Since saponification is complete in 20–30 minutes, it is possible to have three kettles to one autoclave.

Details are given of the manufacturing process in the case of a typical lime-base grease, followed by formulæ for machine, cup and pressure greases, all made by the same process.

Ball-bearing greases can be made from lime or soda soaps, and the following specification is given: Drop point above 60° C.; ash below 2% for soda base and under 4% for lime base; water content under 2%.

Wagon greases for use with guns are made by the open-pan process from fatty acids, and should have a drop point above 45° C., ash under 4% and water content less than 6%. A number of typical formulæ are given.

Graphite greases are used for water pumps, etc. The graphite must be free from abrasive matter and serves to reduce the coefficient of friction. It is incorporated in cup greases before filling off or mixed into the finished grease by milling.

Axle and rope greases are made from fatty acids instead of glycerides, and contain varying proportions of fillers.

Soap-thickened Mineral Oils. These are used as compressor oils, gear and transmission oils. Soaps of Pb, Al, Ca, Mg, K and Zn are utilized. Mineral oils containing sulphur in conjunction with lead soaps give excellent service.

High-melting Greases for Hot Bearings. These are used for bearings heavily loaded, and consequently running at rather higher temperatures, *e.g.* edge, roll and cement mills, and have the following specification: Drop point 120–230° C.; ash below 5%; water under 1%.

The fatty material used must have as high a content of stearine as possible, and tallow, horse fat, cotton stearine, montan wax and rape oil are commonly used with Na, Ca, K and Mg bases. The mineral-oil base must have a low wax content.

Soda-base Greases. These are water-soluble products, their characteristics depending on the percentage and type of fat used, type of mineral oil base, temperature of manufacture and free alkali content. Excess soda tends to prevent a fibrous structure and raises the m. pt.

The water content also has a great influence on the nature of the finished grease. If the grease during manufacture is heated until all water is driven off and then quickly cooled, a gelatinous mass is produced which is easily broken down by mechanical stirring. Slower cooling yields a good fibrous grease of high m. pt.

Gear Greases. These must be fluid enough to flow into the working parts, but not so thick that power losses occur at low temperatures. The consistency should remain as uniform as possible.

They are made in open steam-heated kettles with a cooling device and good stirrer. The manufacturing process is fully described and typical formulæ are given. In general, heavy machine oils or cylinder oils are used.

Chain and Transmission Greases. These must have good adhesion, and are usually manufactured from bitumen or residual oils and soda soap in an open steam-heated kettle.

Soda-base High-melting Greases. These are used for the bearings of heavy machinery where there is no contact with water. The manufacturing process and typical formulæ are given.

Hot Neck Greases. These are used for the bearings of metal rolling mills and are also made in briquette form. Their specification is as follows: flash point above 250° C.; softening point above 60° C.; drop point above 78° C.; ash below 3%; water under 0·1%.

The manufacturing process and typical formulæ are given. A fire-heated kettle is generally used. A high content of soda–stearine soap in an oil of medium viscosity is recommended.

Cold Neck Greases. These are also made in briquette form, and are used for large bearings, roll mills, etc.

The specification is: Ubbelohde drop point above 50° C.; ash below 6%; water content under 6%. They contain less soap than the hot neck greases.

Special Greases. These include lubricants for steam, water, caustic soda, gas-oil and gasoline valves. A number of formulæ are given, and the method of manufacture is described.

The article concludes with a full description of the A.S.T.M. method for determining the worked and unworked penetration of greases. D. L. S.

621.892.25

824. Laboratory Service Testing of Automotive Greases. E. N. Klemgard. *Ind. Eng. Chem. Anal.*, 1936, **8**, 83–92.—An informative article on the importance and necessity of developing service tests of value in formulating improved automotive greases to meet more adequately the more severe lubrication conditions of modern cars and high-speed driving. Laboratory service tests have been devised which permit comparisons of service properties to be carried out more expeditiously than the more laborious road tests. Tests of pressure gun greases for retentivity in plain pin and screw type, shackle-bolt apparatus indicate that neither the kind of soap base, the viscosity of the oil in the grease, the penetration value nor slight variations in soap content along make one product better than another. Probably the combination of these factors and the modifying agents present which influence adhesion, aeration and stability of the greases while in the shackles are the important items in determining the retentivity. Calcium and aluminium base greases showed minor differences in retentivity when tested in the presence of water. The behaviour of universal joint grease was examined in an apparatus consisting of two joints connected by an intermediate shaft, the assembly being motor driven. It was concluded that neither

a penetration nor melting-point specification was essential, and the presence of free acid or alkali was not a serious disadvantage. The water content should be below 1·0–1·5%. Wheel-bearing greases were tested in the front wheel-hub and spindle assembly from a model A Ford car suitably adapted. It was shown that the worked penetration might vary over the range 210–240; water up to 1·1% produced no objectionable corrosion or discoloration; the minimum Ubbelohde drop point should be 135° C. and the maximum ash content 5%. The copper strip test is of importance because of the possible use of sulphur compounds having "extreme pressure" characteristics. Steering-gear greases were tested in a suitable assembly at temperatures ranging from — 40° F. to 180° F. At low temperatures the dynamic efficiency was lower than the static, *i.e.* initial movement of the gears was secured with less effort than was necessary for moderately rapid turning of the steering-wheel. Film-strength Timken tests showed no failure at 40,000 lb. pressure and a rubbing speed of 100 ft. per minute. The investigation on equipment for water pump grease had not been completed. G. R. N.

665.521.5

825. Operator's Woes on Lubrication. F. L. Faulkner. *J.S.A.E.*, 1936, **38**, 133–143.—In this article the author bewails the lack of standardization of products and tests, and pleads for co-ordination between laboratory and service data. Instancing the troubles besetting the operator, he quotes the recommendation, by different oil manufacturers, of no less than six grades (S.A.E. 10–60) to lubricate the engines of his fleet, comprising six different makes of vehicle of varying age operating all over the United States. A fresh complication has recently arisen in the classification of oils by manufacturers according to operating temperature conditions. This year there are six different classes, and, to make matters worse, manufacturers are not agreed about the temperature ranges. He would like to see only two grades of oil for all makes and ages of vehicle, one for summer and one for winter. According to his view, Viscosity Index and Oxidation Susceptibility are the points of most importance, and he concludes that since lubrication accounts for only 3% of the total cost of the vehicle (against 22% of the total cost for all operating charges, excluding driver's wages), it is folly to gamble with such a small proportion in buying cheaper oil. He avers that the establishment of regular drainage periods which are admittedly particular to the vehicle and running conditions is necessary, and his main criterion of change is a maximum of 1% of the oil insoluble in petroleum ether. Thinner oils tend to reach this maximum sludge content in about two-thirds of the mileage it takes a thicker oil; but he considers it worth while to tolerate a higher consumption of these thin oils, because if the vehicle is lubricated with these right from the start, wear is minimized and starter battery life prolonged.

As far as transmission and chassis lubricants are concerned, the same trouble exists as with crank-case oils. There is no agreement about what is a satisfactory extreme pressure lubricant (which incidentally had to be produced to lubricate gears housed in sets which contain much less oil than formerly), and none of the test machines available gives concordant results. He would like to see one grease for wheel bearings and universal joints, a special water-pump grease, a transmission and differential lubricant and a high-pressure-gun grease. A discussion follows the paper.

J. L. T.

665.521.5

826. Analysis of Rectification of Lubricating Oils. A. Skoblo, D. Gusman and A. Kyurkchan. *Azerb. Neft. Khoz.*, 1935, **6**, 69–72.—To obtain a more or less sharp separation of the fractions when distilling heavy distillates, stripping sections are essential. An enrichment of the vapours leaving the evaporating section with heavy components is also helpful. This may be achieved by either adding heavy components to the original raw material or by flushing the evaporation section. A satisfactory separation of distillates taken off from the upper sections can also be assured without stripping sections, when, however, the number of plates is increased correspondingly in the concentration section, *i.e.* to some extent the stripping sections and the plates are interchangeable. The ability to separate fractions in the complicated tower is given mainly by the number of caps in the concentration section of

each section. This explains the better separation of fractions assured by the Foster Wheeler towers as compared with the Alco and Badger towers. For. Petr. Techn.

665.543.061.5 : 547.724.1 : 668.3

827. Patents on Lubricating Oil. Texaco Development Corpn. and A. H. Stevens. E.P. 445,317, 7.4.36. Apparatus and method of refining hydrocarbon mineral oils by selective solvent extraction using furfural.

665.521.5 : 668.3

Deutsche Gasolin A.G. E.P. 445,731, 17.4.36. Refining of lubricating oils by treating them at temperatures below — 2° C. with sulphuric acid in quantities of 6–30% by wt. of the oil.

665.545.3 : 668.3

Sharples Specialty Co. and L. D. Jones. E.P. 445,908, 21.4.36. Dewaxing of lubricating oils using 1 : 3-dichloro-, 2-methyl-propane as solvent.

665.543.061.52 : 668.3

M. B. Miller & Co., and J. S. Withers. E.P. 445,942, 22.4.36. Solvent extraction of lubricating oils using 18–38% of phenol and 57–77% of cresylic substances; 5% of the higher homologues of pyridine may be added to the phenol.

665.521.5 : 668.3

Standard Oil Development Co. E.P. 445,813, 20.4.36. Improved lubricant comprising a hydrocarbon base oil and a small amount of a metallo-organic agent, *e.g.* trimethyltriphenyl tin, trimethyl tin, hexaphenyl tin, or lead, tetracresyl bismuth, tetramethyl mercury, hexaphenyl lead, triethyl tin, diphenyl bismuth, etc.

665.521.5 : 668.3

Standard Oil Development Co., and C. Arnold. E.P. 446,314, 28.4.36. Emulsification of oils, the emulsifying agent comprising a sodium soap of an oil-soluble sulphonic acid derived from petroleum. A small quantity of an ethanolamine soap of sulphonic acid derived from petroleum is added.

665.521.5 : 668.3

A. Duckham. E.P. 446,396, 29.4.36. An anti-corrosive upper cylinder lubricant is prepared in the liquid, solid or semi-solid form by mixing aliphatic hydrocarbons, esters of mono- and/or di-hydric alcohols, *e.g.* ceryl alcohol and/or *iso*cholesterol as formed in non-mineral waxes and aromatics, *e.g.* naphthalene and/or anthracene, together with triethanolamine.

665.521.5 : 668.3

Atlantic Refining Co. and W. M. Malisoff. E.P. 446,567, 27.4.36. Manufacture of lubricating oils by adding from 1–3% by wt. of tricresyl phosphate to a natural viscous hydrocarbon oil.

665.545.3 : 668.3

Standard Oil Development Co. E.P. 446,607, 4.5.36. Improvement in centrifuges for dewaxing of oils. The inner wall of the centrifuge is perforated and covered with a filter blanket.

665.521.5 : 668.3

Bataafsche Petr. Mij. E.P. 446,716, 5.5.36. Manufacture of lubricating oil and wax by adding a pour-point reducing agent to the hydrocarbon oil, *e.g.* distearylpicene and a diluent 37½% by wt. of alcohol and 62½% by wt. of benzene and filtering at — 20° C.

665.545.3 : 668.3

R. E. Manley. U.S.P. 2,040,056, 5.5.36. Dewaxing of hydrocarbon oil in a cycle of operations using propane.

665.521.5 : 668.3

R. E. Manley and H. H. Gross. U.S.P. 2,040,057, 5.5.36. Low pour-point lubricating oil is produced from a blend of lubricating oil of relatively high pour-point

and a minor portion of oil-soluble constituents extracted from a pitch which is primary insoluble in lubricating oil. The pitch is obtained by cracking at high temperatures and pressures, an extraction product separated in the solvent refining of lubricating oil stock.

665.545.3 : 608.3

U. B. Bray and C. E. Swift. U.S.P. 2,040,239, 12.5.36. Removal of asphalt and wax from lubricating oil using propane and approximately 40% of ethane.

665.545.3 : 608.3

U. B. Bray. U.S.P. 2,041,275, 2,041,276, 2,041,277, 19.5.36, and B. G. Aldridge and B. Hopper. U.S.P. 2,041,278, 19.5.36. Separation of asphalt and wax from lubricating oils using liquefied propane.

665.545.3 : 608.3

F. X. Govers. U.S.P. 2,041,677, 19.5.36. Dewaxing of lubricating oils using acetone and benzole.

665.545.3 : 608.3

H. Walch. U.S.P. 2,041,885, 26.5.36. Dewaxing of lubricating oils using trichloroethylene, dichloroethane, etc., and adding to the solution 2–50% by volume of solvent alcohol or magnesium chloride. W. S. E. C.

Fuel Oil.

662.753.323

328. Cracked Oils in Diesel Fuels. J. J. Broeze. *Gas & Oil Power*, April, 1936, **31** (367), 99.—In cracking processes the base product is split up into gases, vapours, which are condensed, and oily residue or coke. The two main schemes of production are illustrated. According to the first scheme, the entire condensate, or pressure distillate, is treated with chemicals and the gasoline fractions are subsequently removed by distillation. Some products of reaction with chemical refining agents thus remain in the pressure distillate bottoms. According to the second scheme, which is now in more general use, the pressure distillate is first distilled to remove gasoline fractions, which are then refined. The cracked gas-oil is thus not subjected to chemical treatment, but a small amount of treated pressure distillate bottoms is obtained by the necessary redistillation of the treated gasoline. Cracked gas-oils are almost entirely comparable with straight-run gas-oils, and are used in large quantities without difficulty.

The cracked residue may contain sludge, and be contaminated with fine particles of carbon. Such residue is, therefore, generally used as under-boiler fuel, and should be incorporated into diesel fuels only if free of sludge and carbon. Pressure distillate bottoms containing products of reaction with chemicals used for refining should never be included in diesel fuels.

This was sometimes done formerly with unsatisfactory results. Misunderstandings regarding the use of cracked diesel fuels have arisen owing to misinterpretation of some articles on the subject. H. H. Blache and G. Vedeler refer to cracked pistons caused by a particular cracked fuel. Although this fuel was doubtless responsible for the trouble, the hypothesis advanced that cracked diesel fuel contains unstable molecules which develop an intense heat while burning, similar to a oxy-hydrogen cutting flame, is shown to be incorrect, since cracked products are more resistant to heat than the base products from which they are obtained. The cause of the trouble may have been due to the oil : (1) having had too low an ignition quality, (2) containing sludgy residues of the cracking process, not used nowadays, causing carbonized or blocked nozzles and spoiling fuel distribution, (3) containing corrosive reaction products from treated pressure distillate bottoms or residue. The third cause suggested is the most probable one, as fuel valve parts were corroded, and the presence of mineral acids and salts in large quantities might make the flames abnormally corrosive, thus burning the piston tops.

Reference to darkening in colour of cracked gas-oils, on exposure to light, has been made in literature. This is due to slow oxidation and polymerization at low temperatures of unsaturated hydrocarbons present in large quantity in cracked gas-oils.

No trouble from gum or change in ignition quality is experienced with a diesel fuel which is stored in the dark and evaporates only on its admission to the cylinder. Further, such secondary reactions may occur in the engine at an increased rate, but at the high temperatures prevailing these reactions are entirely overrun by decomposition and combustion. Also, the influence of any peroxides is a slight increase in ignition quality, which is an advantage. R. A. E.

662.753.323

829. Diesel Fuel Specifications. C. H. Barton. *Petr. Times*, 1936, **35**, 665.—Diesel fuels are generally graded on a viscosity basis. Maximum permissible limits are usually imposed, but it is not usual to set a minimum limit. Too high viscosity may impede flow and cause poor atomization, whilst too low viscosity entails a decrease of penetration in the combustion chamber. It is suggested that control of the temperature of the fuel supply is desirable in order to render the injection arrangements less selective with regard to viscosity. Ignition quality is an important property of diesel fuel, though of less importance than the octane number of gasoline. Of the many methods available as indicating ignition quality, one based on an engine test will probably be adopted for general use. Owing to the lack of definite information concerning the relation between fuel volatility and engine performance, it is not possible closely to specify volatility. In so far as volatility affects carbonization, a coke test, such as the Conradson, is of value. The same test may be used to limit the proportion of residual oil in a diesel fuel. Ash and water contents have their obvious values. The pour test is not entirely satisfactory as a means of assessing the ability of an oil to flow at low temperatures, and where this property is of practical importance the pour test should be amplified by more suitable tests, such as viscosity determination at a significant temperature. It is suggested that the essential properties of a diesel oil are covered by a specification which comprises considerations of viscosity, carbon-forming tendency, ignition quality (for high-speed engines), ash and water contents. H. G.

662.758 : 668.3

830. Patents on Fuel Oil. J. D. Morgan and Ofenbau Gs. E.P. 446,394, 29.4.36. Production of fuel oil from oil and finely pulverized coal the latter being passed through an air-separator to separate fine dust capable of passing through a sieve having 16,900 mesh/sq. cm. before mixing with the oil. W. S. E. C.

Asphalt and Bitumen.

625.042.3

831. Susceptibility of Asphalts to Temperature. A. Holmes, J. O. Collins and W. C. Child. *Ind. Eng. Chem. Anal.*, 1936 (2), 100–104.—The need for some suitable means of expressing the change in consistency of asphalts over the wide range of temperature usually encountered in actual service is demonstrated. After reviewing methods of determining the susceptibility factor, the fluidity factor, the float test index and the Hoepfner–Metzger rigid point, the authors consider that no single factor has been developed which will adequately serve to measure the temperature susceptibility over the entire desired range of conditions, and suggest three methods which can be used in conjunction with one another for this purpose. The first method is the softening point–penetration index which is analogous to the Dean–Davis viscosity index system. Mexican asphalt of low consistency–temperature coefficient was taken as 100, and an asphalt from a cracking unit was taken as zero. From data on these asphalts a chart was constructed for penetration at 25° C. against the index, so that any steam- or vacuum-reduced asphalt could be characterized. The relation between softening point and penetration at 25° C. was $M = kP^2$, where M is the ring-and-ball softening point in ° F. While this method was considered informative for a " normal temperature " of 25° C., for temperatures down to 0° C. the susceptibility factor was taken as the ratio of the penetration at 25° C. (100 grms. 5 secs.) to the penetration at 0° C. (200 grms., 60 secs.). This factor was 3·3 for Mexican asphalt and 7–17·0 for the cracking still asphalt. The third method was evolved to take

care of temperatures above 25° C., and related the penetration at 25° C. to the Furol viscosity at 135° C., giving a fluidity index analogous to viscosity index.

G. R. N.

668.7 : 532.13

832. Viscosity of Tar—Its Significance in the Surfacing of Roads. G. H. Fuidge. *J.S.C.I.*, 1936, **55**, 301–309.—The tars for the four chief methods of road-treatment are at present differentiated mainly by viscosity ranges at specific temperatures. At the estimated temperature of rolling, however, the viscosities (as deduced from viscosity/temperature curves plotted from the formula of Evans and Pickard) are fairly similar. It is, therefore, suggested that the temperature for a standard viscosity, *e.g.* 50 sec. B.R.T.A., termed the equi-viscous temperature (E.V.T.), should provide a convenient means of characterizing road tars, and thereby eliminate a number of disadvantages attached to the present system. The system has been recommended by the Standardization of Tar Products Tests Committee, and proposed limits for the five grades of tar have been tentatively adopted. The E.V.T. of a mixture of tars is approximately the mean of the E.V.T. of the constituents, whilst the reduction in E.V.T. caused by the addition of fluxing oil is approximately proportional to the amount of oil added, and is independent of the initial viscosity of the tar. The most accurate method of determining E.V.T. is by interpolation on the log B.R.T.A. viscosity/log temperature (° F) curve. A formula is derived relating E.V.T. with B.R.T.A. viscosity at one temperature, viz :—

$$\theta_1 = \theta + 11{\cdot}5\,\frac{t - 50}{t + 50}$$

where θ_1 = E.V.T. ° C., θ = temp. of test ° C., t = time of flow. Tables and a nomogram are also given for obtaining the E.V.T. directly. Tar viscometers in general are not suitable for direct determination of E.V.T., but a modified form of the Technico Universal Torsion Viscometer is described by which the E.V.T. may be determined directly.

C. C.

Special Products.

661.471 : 553.7

833. Separating Iodine from Bore-Hole Waters. A. A. Shmuk. Russ. P. 40,333, 31.12.34.—Iodine is recovered from bore-hole waters by electrolysing them during their passage through a layer of activated charcoal using the latter as anode.

For. Petr. Techn.

661.471 : 553.7

834. Separating Iodine from Solutions. A. G. Baichikov. Russ. P. 40,334, 31.12.34.—In the separation of free or combined iodine from its solutions by means of activated charcoal the latter, after being saturated with iodine, is treated with Na_2CO_3 solution for its extraction, and then regenerated with HCl.

For. Petr. Techn.

661.727.1

835. Formaldehyde from Oxidation of Pyrolysis Gases. M. M. Tikhomirova and V. Monakhova. *Azerb. Neft. Khoz.*, 1935, **6**, 79–83.—The oxidation was carried out with air at temperatures from 280° to 340° C., using V_2O_5 as catalyst precipitated on asbestos, refractory clay, and kaolin. The oxidation of the pyrolysed gas yielded 5–11% formaldehyde, 2–3% formic acid and 6–7% acetic acid. Traces of propionic acid were also found in the product obtained in the oxidation of the ethylene and propylene fractions, the amount of propionic acid increasing considerably when oxidizing the propylene–butylene fraction. An aldehyde of higher concentration is obtained when carrying out the distillation in the presence of NaCl, although better results are obtained with $CaCl_2$. The kaolin catalyst carrier was found to be best.

For. Petr. Techn.

665.345.4

836. Drying Oil from Pyrolysed Crude Oil. S. N. Popov and A. E. Beilin. *Azerb. Neft. Khoz.*, 1935, **5**, 98–102.—The usual method for the production of synthetic

drying oils by blowing a pyrolysed crude-oil fraction boiling below 75° C. with air gives low yields of the final product, although it has good drying properties. Experiments were carried out without the use of air by heating the above fraction on a reflux condenser charged with clay. This produces a much lighter synthetic drying oil, but the drying properties were unsatisfactory. The refined light fraction, when mixed with naphtha, yields an anti-knock motor fuel. For. Petr. Techn.

665.345.4 : 668.3

837. Synthetic Drying Oils. S. L. Varshavskii and I. K. Shenfinkel. Russ. P. 39,899, 30.11.34.—Synthetic drying oils are prepared by treating gasoline in the presence of anhydrous $AlCl_3$ with HCl at 100–120° C. for 4 hours. The lower layer is then separated, and treated with cold water, followed by removal of oil from the surface.
For. Petr. Techn.

665.547

838. Preparation of Acid Oil. G. B. Gurwich. *Azerb. Neft. Khoz.*, 1935, **5**, 103–105.—A high-grade "acid oil" was prepared from alkali sludge through the passage of SO_2 produced in the distillation of an acid sludge obtained in the treatment of the pressure distillate with H_2SO_4. For. Petr. Techn.

661.183.2 : 668.3

839. Patents on Special Products. J. C. Morrell. E.P. 445,342, 1.4.36. Production of structural adsorptive or activated carbon by mixing finely divided carbonaceous material and a bituminous binder which chars on heating.

665.547 : 668.3

I.C.I. Ltd., and E. I. Du Pont de Nemour & Co. E.P. 445,417, 1.4.36. Manufacture of alkali metal addition products of aromatic hydrocarbons by reacting sodium with naphthalene hydrocarbons in an aliphatic mono-ether other than diethyl ether. The mano-ether has an O : C ratio of not less than 1 : 4, and contains a CH_3–O group. A diluent may be added if desired.

665.547 : 668.3

W. W. Groves and I.G. Co. E.P. 445,896, 20.4.36. Manufacture of perylene by heating a mixture of anhydrous aluminium chloride containing alkaline chloride and isomeric dinaphthyls to 100–110° C. and adding an oxidizing medium as an accelerator.

662.754.2 : 668.3

J. Y. Johnson. E.P. 446,305, 28.4.36. Purification of alcohols obtained by catalytic hydrogenation of carbon oxides, by subjecting them, if desired after a catalytic pretreatment with hydrogen or gases containing hydrogen, to distillation with an addition of an alcohol of lower b. pt.

662.754.2 : 668.3

Standard Alcohol Co. E.P. 446,614, 4.5.36. Manufacture of ethyl or *iso*propyl alcohol by absorbing ethylene in sulphuric acid under pressure at 70–80° C. The dialkyl sulphate formed is distilled under 20 mm. absolute mercury pressure at 130° C. and then hydrolysed to obtain the alcohol.

665.547 : 668.3

Carbide and Carbon Chemicals Corpn., J. W. Wickert and B. T. Freure. E.P. 446,026, 23.4.36. Preparation of organic compounds containing at least 14 carbon atoms in the molecule, *e.g.* of a new unsaturated tetradecyl ketone and tetradecyl alcohol. Methyl*iso*butyl ketone is condensed with ethylhexaldehyde and, if desired, the reaction is continued to produce an unsaturated ketone by dehydration. This unsaturated ketone is hydrogenated to give a ketone and a secondary alcohol, each containing 14 carbon atoms. The alcohol is converted into the monosulphate of tetradecyl alcohol, and the sulphated alcohol recovered as such or in the form of the alkali or alkaline-earth metal salt.

661.183.2 : 608.3

J. C. Morrell. U.S.P. 446,889, 446,892, 1.5.36. Preparation of non-structural activated carbon by carbonizing a mixture of petroleum coke, carbon black and wood-tar pitch and adding an oil–water emulsion. The mixture is heated in an oxidizing gas in the presence of steam.

A. Jones. U.S.P. 2,039,963, 5.5.36. An apparatus is described for the distillation of dry-cleaning liquors. W. S. E. C.

Engines.

621.019.6

840. Infra-Red Radiation from Otto-Cycle Engine Explosions. S. Steel, A. Wharton and C. H. Roeder. *Engineering*, 1936, **141**, 131–133 and 325–328.—This work comprises part of a general investigation of combustion in an engine cylinder conducted by the National Bureau of Standards, assisted by the N.A.C.A. The apparatus described by Steel in *Nature*, **128**, 185 and *Ind. Eng. Chem.*, **25**, 388, which was used in earlier stages of the investigation, has been modified. Fluorite windows in the cylinder head allow radiations from two zones in the combustion head to be transmitted and focused at the slit of a stroboscope, and thence to the target of a highly sensitive antimony–bismuth vacuum thermocouple, all mirrors in the system being of glass, silvered on the front surface. The mounting and suspension of the Thomson galvanometer previously described by Steel, *Ind. Eng. Chem.*, **25**, 391, were unchanged. The first part of the paper describes in detail major improvements in the former apparatus, engine data and relative energy transmitted by different filters from various sources. The second part presents an analysis and discussion of the research. C. H. S.

621.019.6

841. Spark Photography of Fuel Sprays, and High-Speed Motion Picture Study of Combustion in a Compression Ignition Engine. R. Stansfield, *J.I.P.T.*, 1936, **22**, 328–331.—An abstract of four papers published by the N.A.C.A. on the above subjects. G. R. N.

621.317.755

842. Auxiliary Equipment for Cathode-Ray Tubes. R. R. Batcher. *Instruments*, 1936, **9**, 112, 140.—The first part describes the application of circular time bases which may be produced both electrically and mechanically. The second deals with means for translating the various non-electrical magnitudes such as time, velocity, pressure, etc., into electrical potentials which may be amplified if necessary and applied to the deflection plates of the tube. P. D.

621.43–24234

843. Cylinder Wear, Where and Why. S. W. Sparrow and T. A. Scherger. *J.S.A.E.*, 1936, **38**, 117–125.—In the main, whatever the circumstances or amount of wear, the general characteristics of wear are the same. Maximum wear is in line with the upper limit of travel of the top compression ring during normal running, but at high speed and full load wear is fairly uniform over the full length of piston travel. Faulty water distribution or excessively high jacket water-temperature accelerate wear, the former locally and the latter generally by reason of breakdown of the thinner oil film. For example, when the water outlet temperature was 170° F. wear was negligible, but when it reached 205° F. wear was excessive. Other factors having a major influence are too strong an oil control ring, which too effectively removes the oil film, thereby permitting the compression rings to cause excessive wear, and also the presence of abrasives, such as road dust and hard carbon. As far as piston ring wear is concerned, the top compression ring wears more than the second, and less than the oil control ring, even when abrasives are present, since the top ring tends to pulverize these to dimensions smaller than the thickness of the oil film. It is concluded that wear is due to inadequate lubrication, which is not always synonymous with insufficient lubrication. The article is illustrated with diagrams and photographs. J. L. T.

621.43.634.2

844. 120-H.P. 12-Cylinder Airless Injection Engine. Anon. *Engineering*, 1936, **141**, 448.—A short description of a new 12-cylinder vee model engine. It has a bore and stroke of $4\frac{1}{2}'' \times 5\frac{1}{2}''$, and is particularly suitable for installation for yachts in the highest classes. The engine develops 120 H.P. at 1200 r.p.m. or 130 H.P. at 1300 r.p.m. All moving parts are enclosed, including the flywheel, and all drives are of the gear type, and are also enclosed with the exception of the chain drive hand-starting gear. Pressure lubrication is provided for all bearings, and a torsion damper is fitted. The engine employs the Acro combustion chamber and Bosch injection.
C. H. S.

621.43-634.2

845. 7½ H.P. Horizontal Oil Engine. Anon. *Engineering*, 1936, **141**, 462.—A new engine in the Ruston & Hornby range. The engine is manufactured as a transportable or stationary model and simplicity and ease of starting are special features. A cartridge holder is provided, but it is claimed that this is rarely required even in the coldest weather. The cylinder is integral with the bedplate, and renewable liner is fitted. The crankshaft bearings are lubricated by oiling rings, and the crankshaft is fitted with balance weights. The camshaft gears run in an oil-bath, and the engine speed can be adjusted whilst running. The fuel pump is C.A.V. Bosch, and the atomizer is of the Ruston pattern and manufacture. The engine is a general purpose type with many possible applications.
C. H. S.

621.43.052

846. General Question of Supercharging. O. Thornycroft. *J. Inst. Aut. Eng.*, 1935, **4** (3), 21–39.—The gains and losses which are to be expected from supercharging a petrol engine of a small car and the oil engine of a large commercial vehicle are evaluated. The tendency of a fuel to detonate limits the compression ratio (C.R.) permissible in any petrol engine and an engine designed to take full advantage of the anti-knock value of the available fuel cannot be supercharged unless the C.R. is suitably reduced. The effect of supercharge on the E.35 engine is shown. With a fuel of 83 Octane No. the highest permissible C.R. without supercharge is 6·55 to 1, whereas with 8 in. Hg supercharge the C.R. has to be reduced to 5·5 to 1 if allowance is made for rise of temperature of the charge. Curves are given showing the increase of torque and reduction of thermal efficiency obtained. Torque curves are also given showing the effect of increasing the octane no. to balance the effect of supercharge up to 8 in. Hg. Here it was necessary to increase the octane no. from 70 to 89. In the supercharging of petrol engines for road vehicles it may generally be assumed that fuels of highest octane no. would not be available, and consequently the tests on fuel of fixed octane no. with reduction of C.R. as the supercharge is increased are probably the more important.

It is shown that the true induction temperature with a highly supercharged engine using no "hot spot" may be no greater than that of a heated unsupercharged engine. With supercharging the hot spot can be discarded due to the good mixing of air and fuel through the blower. A complete analysis of the torque output on a full throttle of a 1000-c.c. 4-cylinder engine over a speed range of 1000- to 5000 r.p.m. is given using 65 Octane No. fuel and a supercharger designed to give 8 in. Hg boost at 2000 r.p.m. This shows the increase in average torque at speeds corresponding to 14–28 m.p.h. on the road to be just under 17%, whilst the mechanical efficiency of the engine at 3000 r.p.m. is increased from 80 to 86% by virtue of the greater output when supercharged. The author points out that the rate of heat flow is one of the factors which may limit the degree of supercharge that can safely be used and directs attention to the prevalence of engines where the exhaust and induction passages appear to have been designed with little regard to the water passages.

In the design of motor-car engines for normal use the aim must be to obtain the maximum power at the lower speeds, but it is necessary to curtail the heat flow at high speeds by throttling or by-passing the blower if trouble is to be avoided. Curves are given showing the effect of using a supercharger giving 11 in. Hg boost at 1500 r.p.m. and automatically controlled to constant pressure at higher speeds. With this arrangement the improvement of torque at 14–28 m.p.h. would be 28%. Such a super-charger would increase the engine weight by about 12%.

The author deals with the question as to whether an increase of low-speed torque of 28% by increasing engine size is a more economical method from the point of view of first cost, power/weight ratio, fuel consumption and maintenance. With a compression-ignition engine the limitations imposed by detonation do not arise. Tests on a single-cylinder engine of 6 in. bore × 6½-in. stroke at 2000 r.p.m. show that the following results might be expected from a commercial vehicle engine of 130 B.H.P. at 2000 r.p.m., assuming a pressure controlled supercharge of 6 in. Hg, a fixed C.R. and injection timing. (1) Maximum B.M.E.P. would be increased by 13½%. (2) Maximum cylinder pressure increased by 7%. (3) Fuel consumption at half original full torque and two-thirds full speed would be increased by 3%, but for equal proportions of full load the specific consumption would be unchanged. (4) Total weight of power unit would be increased by 5%. (5) Combustion knock at full torque would be very much reduced due to shortening of ignition delay. C. H. S.

Coal.

662.757 : 608.3

847. Patents on Coal. H. W. F. Gifford. E.P. 445,728, 17.4.36. Treatment of coal–oil mixtures prepared by first grinding the coal with middle and heavy fractions of oil and adding the low-boiling fraction after completing the grinding; the mixture is treated at low temperatures in the presence of a catalyst containing porous bauxite impregnated with aqueous aluminium chloride, and subsequently dried. The temperature of the catalyst is maintained at 250–300° C.

662.74 : 608.3

S. P. Miller. U.S.P. 2,040,100, 12.5.36. Treatment of tar to recover tar acids as carbolate and to recover an oil distillate and residue. Tar acids and neutral oils are volatilized from the tar in a current of inert gas. The gases and vapours from the inert gas distillation are cooled to condense part of the oil vapours of the desired boiling range, and tar acids are extracted with an alkaline reagent to remove them.
W. S. E. C.

Economics and Statistics.

665.5 : 68(47)

848. Petroleum Industry in U.S.S.R. Turkmennefi Trust. I. Ganitzki. *Mon. Petr. Roum.*, 1936, **37**, 593–595.—The second petroleum base of the Soviet comprises a band of territory extending along the West Ural mountains and the eastern littoral of the Caspian Sea, more than 3000 km. long. It stretches from the Arctic Ocean to the Tshikichlar field on the Iranian frontier. The development of the territory awaits the completion of the Neftedag–Crasnovodsk 10-in. pipe-line, which was commenced in 1935, and will be in operation this year. It will be 165 km. in length. The policy will be to ship Neftedag crude to the Volga until refining equipment is available at Crasnovodsk, where two pipe stills for primary distillation and a cracking unit are being constructed. Then reduced crude will be shipped to the Volga to be treated at Gorkii to produce lubricating oils. The gas-oil will be used on the Sredasiatica railway, which in 1936–1937 will be entirely diesel-engined. The history of the Neftedag field is reviewed with particular attention to Gubkine's work in 1934. Two productive horizons have been established: (*a*) a layer of granular sand, very rich in oil, between clay deposits and different-coloured sands known as "crasnotwet," (*b*) a deep layer, discovered in 1934, composed of fine sand, which is found between the sediments known as "ackciogâl." The latter varies in depth from 690 m. to 380 m. The field produced about 200,000 tonnes in 1935, and in 1937 it is expected to produce 1,100,000 tonnes. This will depend on the completion of the pipe-line, as several wells have been shut off because of lack of facilities. Neftedag crude gives about 35% of high-quality lubricants, whilst from the residue bitumen can be prepared. The island of Tcheleken yields a crude from which an excellent medicinal vaseline is prepared. The article describes several other fields in Turkmenistan which are under survey, particularly the Tshikichlar region, where many mud volcanoes abound. Some of these contain crude oil and others sulphur. It is concluded that the Turkmennefi Trust has many sources of petroleum which are not less important than those of the Vostoconeft Trust.
W. E. J. B.

REVIEWS, BOOKS RECEIVED, AND NEW PERIODICALS.

Reviews.

665.54(02)

PETROLEUM REFINERY ENGINEERING by W. L. Nelson. Pp. viii + 647. 1936, McGraw-Hill Publishing Co., London. 36*s*.

IN the preface of this volume the author suggests that among the large number of valuable reference books on petroleum refining and the derivatives of petroleum, there is none which deals adequately with the fundamentals of engineering design and processing. He believes that this treatise should be useful both to engineering students, plant superintendents, chemists and foremen in the petroleum industry, and also to chemical engineers in general outside that particular field, in view of the possibilities of application of refinery practice to other industries.

While it is obviously impossible to cover the complete field of petroleum refinery engineering and its allied subjects in the space of 600 odd pages, the author has gone a long way towards the production of a volume which is eminently readable by the various classes of technicians referred to in his introduction.

The volume is divided into four sections, Parts I and II providing an introduction to Refining and Processing, whilst Parts III and IV deal with Principles of Design and Plant Processing respectively.

It is to the refinery technologist in particular that these latter sections are of interest, being up to date and accurate in their collected information, and although of necessity rather abbreviated for reasons of space, there is more than sufficient to give the student of refinery engineering and processing a sound grasp of the principles involved.

The chapter on tube-still heaters is somewhat disappointing, as it omits at least two of the most modern types of furnace design and includes others which are now generally admitted to be out of date.

While flue-gas preheating and recirculation is discussed, the much more scientific method of forced draught, with consequent short-flame combustion, is not mentioned at all.

In the section on Processing, and Cracking in particular, claims are made for certain processes which to the reviewer appear difficult to substantiate, and also some of the treating equipment referred to is of doubtful utility when large throughputs have to be considered. Nevertheless, the volume well deserves the attention of the refinery technologist in general, especially as it has at the end of each chapter a comprehensive series of references to which the student can turn for more detailed information if required.

C. E. SPEARING.

621.436(02)

MAINTENANCE OF HIGH-SPEED DIESEL ENGINES. Arthur W. Judge. Pp. 187, 170 illustrations. 1936, Chapman & Hall, Ltd., London. 10*s*. 6*d*.

This volume is a practical handbook primarily intended for the use of fleet owners, maintenance engineers, drivers and mechanics. The author commences with a simple description of the four-cycle and two-cycle types, and explains the main differences between the conditions obtaining in diesel engines and gasoline engines. The second chapter is devoted to a more detailed description of the various components peculiar to the diesel engine, and various types of combustion heads are described before passing on to general maintenance, which is dealt with under four headings, viz.: Inspection, Routine Attention, Running Repairs, and General Overhauls, and practical hints as to where troubles are most likely to occur. Examples of servicing periods are given. Separate chapters are devoted to the cylinders, pistons and rings, valves and seatings, conrods and crankshaft, fuel-injection system, and pump timing and governors. Each of these chapters deals very fully with its subject, especially from the point of view of overhauls, and much information is given on working tolerances and special tools available for dealing with various repairs on many different types of engine. Chapter X is devoted to starting procedure and running troubles. The

various operating troubles are dealt with separately, and the probable causes and remedies are given in tabular form. After a special chapter dealing with glow plugs, filters, etc., which also includes a brief reference to suitable fuels, the author deals at length with the popular C.A.V.-Bosch fuel-injection equipment and its maintenance. At the end of the book a "fault-finding chart" is given, which should prove useful. The book is concise and well illustrated, and should be of great use to people in practical contact with the C.I. engine used for transport and small marine work.

C. H. SPRAKE.

Books Received.

532.511 : 662.987.3

ENGINEERING DATA ON FLOW OF FLUIDS IN PIPES AND HEAT TRANSMISSION. Product Engineering Dept., Crane Co. Pp. 84. 1935, Crane Co., 836 S. Michigan Ave., Chicago. $1.

This booklet contains data on the subjects of Fluid Flow and on Heat Transmission which have been obtained from research carried on by the Crane Company or from reliable books or other publications. Information is included on: the pressure drop of water, steam, air, oil, etc., flowing through pipe; the flow of water, steam, air through orifices; heat transfer from steam pipes to water and oil; determination of thickness of pipe covering; steam tables.

54(02) 53(02)

HANDBOOK OF CHEMISTRY AND PHYSICS. Edited by Charles D. Hodgman. 20th edn. Pp. xiv, 1951. 1935, Chemical Rubber Publishing Co., Cleveland, Ohio. $6. (London: A. Bird, 22 Bedford St., W.C. 2; A. Harvey, 17 Market St., E.C. 1. £1 5s.)

The twentieth edition of this well-known handbook contains over three hundred pages of new matter, and several of the tables have been completely revised and re-written. The table of Physical Constants of Organic Compounds is an example, having been considerably enlarged in scope and simplified in form. Data relating to over 5500 organic compounds are given and, instead of the usual tabular style, have been arranged as separate paragraphs for each compound. Extensive cross-references are used and a formulæ index is given.

622.323

GAS CONSERVATION. John A. Zublin. Pp. ix + 74. 1936, Universal Engineering Co., 2369 East 51st Street, Los Angeles, California.

The Report of the A.P.I. Technical Sub-Committee on Gas Conservation (1927) stated that: "The conservation and efficient utilization of gas are of paramount importance in the conservation and economical production of oil." This book deals with the necessity of gas conservation, discusses the theoretical aspects of the subject, and concludes with a description of the application and operation of a gas extractor designed by the author.

629.123.24(02)

TANKER TECHNIQUE, 1700–1936. B. Orchard Lisle. Pp. 84. 1936, World Tankship Publications, 616 Cecil Chambers, Strand, London, W.C. 2. 2s. net.

In the March 1936 issue of the *Journal*, a paper was published on "Development and History of the Tankship" by B. Orchard Lisle. The present work is a very considerable amplification of that paper, and contains much original information on the subject of the progress in tanker design through the period covered.

661.183.44

BENTONITE: TECHNOLOGY AND INDUSTRIAL USES. 1936, American Colloid Co., 363 West Superior St., Chicago. $2, including supplements supplied for one year.

This consists of a series of data sheets prepared by the American Colloid Co. on the subject of Wyoming bentonite and its industrial uses. The properties and commercial application of the material are covered, including its use in stabilizing emulsions and in insecticides.

662.742

REPORT OF TEST BY THE DIRECTOR OF FUEL RESEARCH ON A RETORT OF THE COAL RESEARCH SYNDICATE, LTD., AT MANSFIELD COLLIERY, MANSFIELD, NOTTINGHAMSHIRE. Pp. iv, 28. 1936, H.M. Stationery Office, London. 9*d*. net.

The two retorts comprising the plant tested are of the vertical intermittent type, the coal being heated by the downward passage of hot gases through the charge. Each retort is a brick-lined structure about 25 ft. high and circular in cross-section tapering from 10 ft. 4 in. in diameter at the bottom to 10 ft. at the top.

Four runs were made and no major difficulties encountered, the throughput being at the rate of 30·8 tons per 24 hours.

The yield of smokeless fuel was 13·55 cwt. (dry) per ton of dry coal, and the tar collected amounted to 14·8 gallons per ton of coal as charged. The tar was suitable for hydrogenation.

New Periodical.

665.5(05)(44)

BULLETIN DE L'ASSOCIATION FRANÇAISE DES TECHNICIENS DU PETROLE. 44 Rue de Rennes, Paris (VI^{e}). Published quarterly. Annual Subscription outside France: 75 francs per annum. To members of the Association: 10 francs per annum. Size 24 cm. × 15·5 cm. (9½ in. × 6⅛ in.). Pp. 1–84. (Jan.–March, 1936).

The small bi-monthly Bulletin of the Association Française Techniciens du Petrole, of which 33 issues were made, has now been considerably enlarged, and appears as a quarterly publication under the above title. The first issue of the new series was made in April 1936, and is numbered "No. 34, January–March, 1936."

In the foreword by the Committee of the Association it is emphasized that the new Bulletin will form a link between the members of the A.F.T.P., and will present a record of the work of French petroleum technologists and of the activities of the Association.

The first quarterly issue contains the Annual Reports by the Chairmen of each of the five Sections of the Association on the meetings held by their Sections during the Session 1935–36. These are followed by seven technical papers:—

"The Search for Petroleum in the French Colonies," M. Mercier.
"Note on the Position of the Search for Petroleum in Morocco at the end of 1935," M. Mercier.
"Oil-fields of Morocco," Ch. Baron.
"De-colorizing Earths," L. Delemar, J. Navarro and C. L. Alexanian.
"Thermometry in the Petroleum Industry," R. Sigwalt.
"Welding in the Construction of Pressure Vessels," M. Courtan.
"Progress in the Treatment of Roofs for Storage Tanks," M. Rott.

A short Abstracts Section concludes the issue.

The Association is to be congratulated on the attractive format adopted for its new series of Bulletins, and the interesting and varied nature of its contents. The Bulletin will be received by the Institution Library, and Abstracts of its principal Papers will appear in the Abstracts Section of the *Journal*.

ABSTRACTS.

	PAGE
Geology	330 A
Geophysics	336 A
Drilling	337 A
Production	340 A
Pipe-Lines	342 A
Chemistry and Physics	344 A
Analysis and Testing	344 A
Refining and Refinery Plant ...	346 A
Cracking	349 A
Hydrogenation	350 A
Gas	350 A
Motor Fuels	353 A
Kerosine	356 A
Lubricants and Lubrication ...	357 A
Paraffin Wax	359 A
Fuel Oil	361 A
Asphalt and Bitumen	362 A
Special Products	364 A
Engines	369 A
Detonation	369 A
Coal and Shale	370 A
Economics and Statistics ...	371 A
Books Received	372 A

AUTHOR INDEX.

The numbers refer to the Abstract Number.

Adams, F. W., 904
Adams, J. E., 859
Adamyan, L. K., 968, 971
Albright, J. C., 918
Alden, R. C., 924
Aldrin, E. E., 931
Anderson, A. P., 943
Armentrant, A. L., 874
Aston, J., 866
Avnesova, S. M., 968

Badger, W. L., 906
Baender, F. G., 945
Bataafsche Petr. Mij., 975
Batcher, R. R., 976
Beard, L. C., 936
Bencowitz, I., 956
Bignell, L. G. E., 872
Blow, G., 874
Blümner, E., 982
Boe, E. S., 956
Born, S., 973
Bowman, B. A., 905
Breth, F. W., 939
Broughton, G., 904
Brown, L. T., 929
Brownlie, D., 948, 981
Braun, J. H., 895
Bryson, H. C., 967
Buc, H. E., 931
Buck, E. O., 858
Butkov, N. S., 912

Carbide & Carbide Chem. Co., 975
Carbo-Norit Union, 935
Carpmael, A., 923
Christensen, L. M., 929
Colburn, A. P., 909
Comp. des Mines Vicoigne, 913
Conine, R. C., 869
Conn, A. L., 904
Conway, M. J., 915
Corson, B. B., 914
Cox, E. R., 885
Craig, L. C., 892
Crawford, J. W. C., 975

Daimler-Benz A.-G., 977
Davenport, E. S., 867
Degea A.-G., 977
Deibel, G., 897
Deiss, E., 960
Debryanskii, A., 917
D'Ouclen, J., 855
Dornte, R. W., 940
Dunstan, A. E., 922
Durier, Y., 927

Easton, H. D., 860
Egloff, G., 898
Elliot, G. R., 856
Erlikh, B. M., 969
Espach, R. H., 946

Fenske, M. R., 932
Ferguson, C. V., 940
Flaherty, J. H., 868
Forrest, H. O., 943
Forward, W. L., 874
Foster, A. L., 953
Fragen, N., 906
Fry, E. M., 932

Gee, P., 944
Gilbert, W. V., 945
Gilfoil, W. S., 890
Grace, W. S., 874
Graham, H. W., 865, 868
Graham, W. H., 874
Greenwood, H. D., 897
Grosselli Chem. Co., 922

Hackford, J. E., 932
Hart, W. B., 901
Howes, D. A., 922
Hughes, J. D., 871
Hume, H. V., 950
Hunter, T. G., 945
Huntington, R. L., 916
Hyde, E. C., 874

I.C.I. Ltd., 975
I.G. Farbenind., 975
Ihrig, H. K., 873
Ipatieff, V. N., 914

Jellinek, H., 938
Johnson, C. H., 849
Johnson, J. Y., 975
Jones, L. D., 945

Kähr, H., 951
Karasik, M. M., 911
Kennedy, E. R., 886
Kiersted, W., 944
Klatt, R., 938

Lacey, W. N., 886, 875
Lane, E. K., 874
Lazar, A., 974
Lee, A. R., 962
Legataki, T. W., 925
Liberthson, L., 939
Licence, A. B. C., 896
Lorentzen, J., 979

McCarty, B. Y., 944
MacLean, G., 954
Macleod, D. B., 888
Mandelbaum, M. R., 928
Mănescu, N., 984
Marshall, V. O., 903
Means, E. A., 895
Meintzer, O. E., 864
Michaux, F. W., 858
Middleton, W. W., 934
Mills, B., 878
Mitchell, J. G., 962
Murphy, G. B., 887

Nash, A. W., 945
Nelson, W. L., 919
Neptune, F. B., 924
Newman, A. B., 910
Newman, E. L., 895
Nicks, A. A., 874
Nieuwland, J. A., 891

Petrascheck, W., 854
Pfeiffer, J. P., 955
Pogue, J. E., 983
Poole, J. W., 942
Potts, H. E., 913
Pratt, D. D., 975
Proctor, A. C., 898

Quiggle, D., 932

Rabinovich, E. I., 912
Rassweiler, G. M., 978
Rather, J. B., 936
Reid, G. H., 975
Renfro, J. C., 874
Reynolds, J. H., 874
Rinsch, C. F., 923
Roberts, A. A., 982
Rubtsov, G. A., 963
Ryder, H. M., 876

Sage, B. H., 875, 886
Sartain, W. M., 884
Sawtelle, G., 852
Scheumann, W. W., 926
Schmidt, E. F., 883
Sharp, H. P., 889
Sharples Specialty Co., 945
Shchitikov, V. K., 930
Shipp, V. L., 972
Silent, R., 870
Sittel, V. J., 882
Smiley, T. F., 862, 863, 877
Smith, A. L., 931
Smith, F. E., 980
Smith, F. J., 889
Smith, G. R., 857
South Metro. Gas Co., 897
Spain, E. L., 951
Standinger, H., 975
Stephenson, H. P., 982
Stout, W., 853
Strevens, J. L., 949, 952
Susanov, Y. S., 902
Sealov, B. M., 965
Swanson, P. F., 928

Tate, F. G. H., 894
Thompson, W. N., 874
Tilbury, L. C., 874
Tosgberg, T. O., 932
Traxler, R. N., 908
Trimble, H. M., 934
Turechek, G. F., 874
Turner, R. H., 907, 908
Twenhofel, W. H., 850

Van Der Werth, 957
Van Doormaal, P. M., 956
Van Horn, L., 943
View, C., 982
Vogt, R. R., 891
Vomesenskii, A. A., 937

Wade, A., 861
Wagner, C. R., 920, 921
Walker, J., 934
Walther, H., 959, 961
Warren, L. A., 894
Watson, K. M., 887
Wien, J. L., 887
Wiggins, W. R., 945
Wilcox, J. A., 874
Wilson, C. W., 851
Withrow, L., 978
Woods, G. M., 964

Young, C. A., 891

Geology.

551.241.1

849. Nomographic Solution for Apparent Dip Problems. C. H. Johnson. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 816–818.—A nomogram is given for determining the apparent dip in vertical sections from the true dip and the angle between the strike and the line of section. This nomogram is based on Herold's formula:

$$\log \tan \alpha = \log \tan \theta - \log \sin \phi$$

where α is the apparent dip, θ is the true dip, and ϕ is the angle between the strike and the line of section. S. E. C.

551.35

850. Marine Unconformities, Marine Conglomerates and Thickness of Strata. W. H. Twenhofel. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 677–703.—The writer in his introduction states that one responsibility and one privilege of a scientist is constant questioning of old concepts and assumptions as to the extent of their application and validity. He then proposes to assume this privilege in regard to the occurrence of gravel conglomerates in marine deposits, their relations to unconformities, the occurrence of unconformities beneath marine deposits and the thickness of deposits. The places of deposition of marine gravels, the depths of water and the relation of deposition sites to sea level are discussed and arguments are advanced with relation to the possible thicknesses and extents of marine gravels and to the possibilities of transportation of large-sized sedimentary units into deep water. The summary of the article states:—

(1) That, with a stationary sea level, in the littoral zone may be gravel deposits, then a bare wave-and-gravel-cut surface seaward, free of deposits, and beyond this surface deposits of a coarseness governed by conditions. When this last area accumulates to the base level of deposition it will begin to grow outward into the sea; the deposits thickening in accordance with the depth and proximity of depth to the shore. Sediments have wider distribution and lesser thickness the less deep the waters and vice versa. Generally the deposits increase in coarseness upwards.

(2) That, with a rising sea level, the landward margin of the deposits moves shorewards and rises stratigraphically with a general tendency to decrease in coarseness upward in any section.

(3) That, with a periodic or intermittent rise of sea level, there is a combination of both results.

The thickness and extent of the clastic gravel deposits are always related to the quantities supplied and to the relation of the deposition sites to the deposition base level. Many marine conglomerates have no relation to unconformities, and many unconformities beneath marine deposits are not indicated by gravels, as, under certain conditions, the surface about to become an unconformity beneath marine deposits is such that gravel deposits are debarred. Changes in texture of clastic deposits have little or no bearing on the presence or absence of an unconformity. Omission of deposition followed by recession is the cause of many unconformities of submarine origin.

The character of the surface of an unconformity and the coarseness of the sediments deposited on it give no basis for estimating the time involved. The thickness of strata deposited during any time interval and the rates of deposition are dependent largely on the relations of the deposition sites, the deposition base level and the regions of supply. A wide range exists for the thickness of deposits possible for any time unit. Other important factors are the currents over the deposition sites and the carbon dioxide content of the waters. B. F. N. M.

551.758.1(765)

851. Age of Mississippian "Ridgetop Shale" of Central Tennessee. C. W. Wilson and E. L. Spain. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 805–809.—The strata between the Fort Payne chert and the underlying Maury shale were divided by Bassler in 1912 into the New Providence shale and the Ridgetop shale. The Ridgetop shale was correlated with parts of the Kinderhook group. Evidence is produced by the authors

to show that this division is not correct, the Ridgetop being merely a phase of the New Providence. It is therefore of Fern Glen age, and not Kinderhook. Palæontological evidence confirms this. S. E. C.

553.631(76)

852. Salt Dome Statistics. G. Sawtelle. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 726–735.—A list is given of the 149 salt domes known in the Texas–Louisiana Gulf Coast area. Tabulated details are given concerning location, operating companies, method and year of discovery, producing horizons, production, and depths drilled. In addition, the yearly progress in finding these structures is indicated. S. E. C.

553.982

853. Source Material for Petroleum and Natural Gas. W. Stout. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 797–804.—Results are given of the chemical analyses of samples of calcareous rocks ranging in age from Point Pleasant (Ordovician) to Delaware (Devonian) and taken from various localities in Ohio. A total thickness of 1160 ft. of rock was tested. The organic matter was extracted by solution in ether after dissolving away the rock. Analysis of this extract showed that the ratio of carbon to hydrogen is remarkably constant, and approaches that of the paraffin series. The quantity of organic matter present varied from 0·06% in a dense limestone to 1·84% in an open-textured dolomite which was saturated with tarry substances. The average content was 0·48%.

The quantity of bitumen per acre in the various formations, calculated from the above figures, is given in the form of barrels per acre. For the Delaware formation, 45 ft. thick, this figure is 7409, and for the Niagara group, 110 ft. thick, it is 10,388. The Cincinnati group (Ordovician) comprises 352 ft. of limestone and 653 ft. of calcareous shale. The bitumen content of the limestone is given as 9659 brl./acre and of the shale as 46,289 brl./acre. S. E. C.

553.982 : 553(436)

854. Austria's Future. W. Petraschecк. *Oil Weekly*, 22.6.36, **82** (2), 60–64.—The 19 tests from 1900 to 1932 were commercially unsuccessful, but commercial gas production was then discovered in the southern limits of Vienna, and satisfactory oil production 40 km. to the N.

The Kalkalpen, built up of several thrust folds of Triassic and Jurassic limestones, occasionally have small seepages, but a test at Gaming was unsuccessful. The Austrian Flysch of strongly folded Eocene, Oligocene and Cretaceous shales and sandstones is likewise unattractive. This Flysch extends through Czecho-Slovakia into the Carpathians and the Polish oil-fields, but has a different facies there. However, there is a small Miocene basin within the Alps, the Lavant valley of Carinthia, which has oil seepages and is promising.

Geologically the only areas holding commercial oil and gas possibilities at present known are the three great marine Miocene basins at the foot of the Alps.

In the Alpine Vienna basin the Sarmatian is oil-bearing and the Tortonian gas-bearing. The inner parts are slightly folded into domes, and are broken by big faults. These domes have long been known to be productive in Czecho-Slovakia, but Zistersdorf is the only commercially productive dome in Austria. This dome is strongly faulted with the Sarmatian deeply eroded on the western part. Wells drilled on the eastern down-thrown block have pierced the fault and found oil in Flysch beds. The oil in Gosting 1 is no doubt derived from Sarmatian sands of the eastern block across the fault. The field is probably 3 km. long and very narrow. The Oberlaa field is a small, faulted dome on the outskirts of Vienna, yielding gas from the western uplifted block. Two wells produce from sands of Tortonian age at depths of 250–260 m. The sands are known to be very lenticular. The Schwadorf dome is the largest in the Vienna basin. Gas was found at 698 m. in the Sarmatian. Geophysical work will probably reveal other domes.

The outer Alpine basin has 1500 m. of Tertiary sediments (Schlier). The Oncophora sands (Helvetian) lie unconformably on the rest. Folding is slight in the centre and northern part, and gas has been found near Wells. At Taufkirchen is a sand up to

9·5 m. thick with 40% of tarry oil, overlying granite and under 130–150 m. of Tertiary cover.

The Tertiary Bay of Graz has given a small production of oil in Jugoslavia. Only the southern part seems important as regards oil. Thick Mediterranean beds may underlie the Sarmatian and Pliocene. Near Radkersburg a little gas was found, consisting of 42% of methane and 45% of hydrogen. G. D. H.

553.982 : 553(498)

855. Present State of Rumanian Oil Exploitation and Exploration. J. D'Onciou. *Bull. L'Assoc. Franc. du Tech. du Petr.*, April–June 1936, **35**, 39.—In 1935 Rumania's production was 8,382,000 tons, against 8,462,000 tons in 1934—about 23,000 tons a day. This production was almost entirely from the two districts of Dambovitza and Prahova, Moldavia and the Buzau District supplying the balance. The principal fields in order are :—

1. Gura Ocnitzei (Dambovitza) subdivided into the zones, Adanca, Rasvad, Viforata, Teis, producing about	9,000	tons a day
2. Bucsani (Dambovitza) producing about	4,500	" "
3. Boldesti (Prahova) producing about	4,000	" "
4. Moreni (Prahova) producing about	3,300	" "
5. Ceptura (Prahova) producing about	900	" "
6. Aricesti (Prahova) producing about	500	" "
The remainder, the activity of which is very much slackened, *i.e.* Chiciura, Bacoi, Campina, etc., producing about	800	" "
	23,000	

The stratigraphy of the petroliferous formations has been determined partly in the course of surface geological survey and partly in the course of drilling operations. These geological divisions are :—

The saliferous series, probably of an Aquitanian, Burdigalian and Helvetian age, a Tortonian reduced to a few layers and an irregularly developed Sarmatian. Upon the Miocene is a mantle of Pliocene which is subdivided upwards into the Meotian, Pontian, Dacian and Levantine. The Meotian and Dacian are petroliferous, the former when folded in anticlines. This and its stratigraphical appearance lead to the conclusion that it is a " petroleum facies " formation. In the Dacian the oil is secondary, and must be affected by the salt or by faults forming vents for the migration of the oil. This migration to the overlying Pliocene occurred at the period of diapirism.

Gura Ocnitzei reached its peak of production in December 1934 with 42,000 wagons during the month; this had fallen to 26,500 wagons in January 1936. The fall will probably increase as drilling has decreased, only 8 wells drilling against 30 rigs in December 1934. Development to the west is dying out with the sinking of the structure and the disappearance of the salt massif; an anticlinal extension is faulted on its southern flank, and as the fault dies out with the sinking of the structure, the saliferous beds disappear and production from the Dacian fails. The Meotic series thin out from 140 metres thick at Adanca to 70 metres at Viforata.

Bucsani took second place in November 1935. In February 1935 it had only 1 well producing 5 wagons a day, and the production for January 1936 was 14,000 wagons; 47 wells had been or were being drilled, of which 26 were producers, 10 were drilling, 7 dry, 2 abandoned from accidents and 2 shut in because of high G.O.R. The west zone is very regular, the east very irregular. In the west the Meotic is about 160 metres thick; 30–40 wagons a day through chokes of 20 mm., a G.O.R. of 160, and a casing pressure of over 100 atms. were recorded in the first wells. The east zone has no two wells alike. In it is the high point of the structure, but the contours are not yet delimited. No diapirism has been found in the axial region, but the saliferous beds were penetrated on the flanks. The Meotic is thicker than in the west zone. Numerous faults downthrow to the S. around the apex area. In the west zone only the Meotic is petroliferous, whereas from a recent electric diagram it seems that a well drilled near one of these faults finds the higher Dacian soaked with oil by migration up the fault. Initial pressures are stronger in the east zone, seeming to indicate a tectonic gap separating the two zones. The Bucsani trend, being S.E.–N.W., has no

resemblance to the general Carpathian strike of S.W.–N.E., suggesting either an isostatic push of the salt or an example of tangential tectonics. The first does not seem probable, as the salt core is not found in the axial region, but saliferous beds are met with on the flanks of the structure. The present conditions of Boldesti, Moreni, Ceptura and Aricesti are briefly discussed.

Exploitation in Rumania has always been ahead of exploration. For several years the big companies, drilling and exploitation methods having greatly improved, have expedited exploration, preceding it by geological and geophysical expeditions. These surveys have been either on extensions of structures already known or in the plain. Bucsani, up to date, is the only survey which has been crowned with success by drilling. At seven other places no encouraging results were obtained by drilling to great depths. At the present time other regions are being explored, of which the most interesting is Brazi, 16 kms. S. of the last sub-Carpathian hills. The slight dip here shown suggests that the Pliocene was already beginning to rest transgressively on this platform.

State modification of exploration privileges is likely to be promulgated soon, to be effective as from January 1, 1936. Several claims for these privileges are situated in the plain S. of Targovesti and Ploesti, and have been prospected methodically by geophysics. They will be explored in the near future, and it is high time this was done, since the present known reserves are too limited to allow the Rumanian production to be maintained much longer at its present level. A tectonic uplift has been indicated by geophysical methods in this region. The first well found the roof of the Meotic at about 2100 metres deep. The first bed is dry, but it seems there is little or no dip. Even if the result is negative, this well will have given valuable stratigraphical indications. We know now that the Meotic stretches farther than 15 kms. from the hills. If tectonic folds are found in this zone, new oil-fields should be discovered in the plain. The reasonable depth of the more or less horizontal Meotic is interesting, because if the well was on the crest of an anticline, the first bed should have had oil, or at least gas shows. It is not in a synclinal basin, because the Meotic would be deeper. Probably the well is in the vicinity of an uplift, or even of the Miocene platform forming the basement of the Rumanian plain and of the Danube valley. This platform was explored near Bucarest before the war, the well showing the Pliocene (not of Meotic) rested very thinly on the horizontal Miocene. B. F. N. M.

553.982 : 553(712.3)

356. Turner Valley new Completion Marks Existence of West Flank. G. R. Elliot. *Oil Weekly*, 6.7.36, **82** (4), 48–49.—Turner Valley Royalties No. 1 well gives 900 brl. of 44 gravity oil from a depth of 6828 ft., and is the largest well yet completed in this field and has the lowest gas–oil ratio. Eight wells have a crude heavier than the 72 gravity naphtha separated from the gas. In Model No. 1 the gravity and the gas–oil ratio have decreased continuously, whilst the daily production has been increasing. Advance 5 A has shown a similar decrease in gravity. The progressive lowering of gravities on the present western edge of the field indicates movement of the oil up dip as the pressure declines higher up the structure, but movement is slow through the irregular pores of the limestone, which seems to dip due west at 30°. As yet there is no evidence of edge water, but it is expected. G. D. H.

553.982 : 553(764)

357. Talco Fault Zone. G. R. Smith. *Oil Weekly*, 8.6.36, **81** (13), 55–58.—From Caldwell county to eastern Hunt county most of the known faults have N. or N.E. closure, and are open to the S. and S.W. Eastward from Hunt county the majority of the faults are open to the E. and S.E. The closed fault E. of Greenville, Hunt county, and that N.E. of Sulphur Springs, Hopkins county, have the best possibilities of Trinity or deeper production.

The Balcones and Mexia–Talco fault zones are closely related, the former being generally downthrown to the E. or S.E. and the latter to the N. or W.

Southwards from southern Oklahoma, the basal Cretaceous sands are divided by a wedge of Glen Rose limestone which thickens down dip (to the S.).

The source of the oil now produced from Comanchean Cretaceous in north-west Titus county and of the heavy oil and gas shows in Limestone county is undoubtedly

in strata of Palæozoic (perhaps Pennsylvanian) age. It seems that no well E. of Dallas county along the Mexia–Talco fault zone has penetrated any formation older than basal Trinity. Oil produced from Trinity beds is not indigenous to them, but originated in Carboniferous strata. Showings of oil and gas in a test drilled in Tarrant county may indicate that Pennsylvanian production is not impossible there, and these Carboniferous beds may underlie the area at Campbell. G. D. H.

553.982 : 553(764)

858. Conroe Oil-field, Montgomery County, Texas. F. W. Michaux and E. O. Buck. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 736–779.—The Conroe field is on the northern boundary of the Texas Gulf Coast province. The first commercial producer came in in December 1931, and by 1933 the limits of the field had been defined. The greatest development of the field took place during that year, the number of producing wells rising from less than 100 to 679, and production rising from 25,000 brl./day to 52,500 brl./day. Well spacing is one well per 20-acre unit.

There is little surface evidence of structure, the surface strata being sands and sandy clays of Lissie–Reynosa (Pleistocene) age. The structure is that of a slightly elongated dome with the major axis trending N.W.–S.E. There are three major faults with an average hade of 51° and trend of N. 82° E. Two of these faults form a central graben with a downthrow of 165 ft., whilst the third, in the N. part of the structure, has a downthrow of 130 ft. to the S. There are, in addition, several minor peripheral faults. All these faults are normal. The three major faults attain maximum displacement near the centre of the uplift and die away towards the edges, where they are lost. The structural uplift, measured on the Cockfield member of the Claiborne series (Eocene), is more than 800 ft., and uplift can be seen in all the overlying beds where formational contacts can be established with sufficient accuracy.

Production is obtained from three horizons in the Cockfield, viz. the Upper Cockfield sand, the intermediate sand, and the Conroe sand. Of these, the intermediate sand is relatively unimportant and the Conroe sand is by far the most important. The Conroe sand has an average thickness of 60 ft., an average porosity of 28%, and an average permeability of 263 millidarcys. The gas–oil level in general is between — 4850 and — 4860 ft., and, although minor irregularities due to porosity variations occur, the levels are remarkably uniform. The oil–water level is found at — 4990 ft. in all the sands except where disturbed by faulting.

The original reservoir pressure, corrected to a depth of 4800 ft. below sea-level, was 2275 lb./sq. inch. Development of the field was from N.W. to S.E., and consequently a pressure differential in that direction arose, but by January 1935 this had fallen to as little as 6 lb./sq. inch. During the last 8 months of 1934 the decline in reservoir pressure was less than 1 lb./sq. inch per million brl. of oil produced.

Details are given of the various drilling and production methods in use on the field. The proven acreage is 17,200 acres and reserves have been estimated to be of the order of 600 million brl. Total production to January 1935 was 40 million brl.

S. E.-C.

553.982(764)

859. Oil Pool of Open Reservoir Type. J. E. Adams. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 780–796.—The Wheat pool is located near the centre of the Delaware Basin, on the E. side of the Pecos river, S.W. Loving Co., Texas. The structure is a wide, flat terrace on the W. flank of the Delaware Basin with several small noses superimposed on the main terrace. There is a marked steepening of the dip near to the E. edge of the producing area, and at present no evidence of closure on the W. Dry edge wells on the N.W., W., and S.W. flanks are all higher than adjacent producers. Production is from the Frijole formation and from the upper sands of the Delaware mountain group, both Upper Permian in age. The Frijole formation consists of dense, black shale and hard, fine-grained, thinly laminated sandstone. The formation is extensively shattered, and many of the cracks are filled with calcite. The Delaware Mountain sands are very fine-grained and uniform with interbedded black shales. Practically no gas cap is present.

It would appear that no local fold existed until long after the Frijole had been deposited, and that at no time was there more than a minor fold of low relief. Movements taking place from late Permian to Tertiary times, the most important uplift

being in the Miocene, caused this low structure to be tilted sufficiently to convert the previously closed dome to an open terrace.

It is presumed that accumulation commenced as soon as the trap was formed, and the problem is the reason for the oil remaining in the structure under present conditions. Explanations follow four main lines: (1) migration does not occur, (2) either a structural trap or a lithological change, at present undetected, must be present, (3) a physical change must have taken place, such as oxidation of the oil or escape of the gas cap during tilting, which has stopped migration, or (4) a critical angle of dip is necessary before migration can take place, and this critical angle has not been reached in the present case. Before a hypothesis can be accepted it must explain the following conditions. Oil or water is found in the top of the Delaware Mountain sands in every well around the pool, and water wells, miles distant, usually show traces of oil. The sands are uniform in texture, and are apparently of uniform permeability. The oil has migrated a certain distance up dip. S. E. C.

553.982 : 553(767)

860. Four Permian Producing Areas Now Indicated by Snow Hill Discovery. H. D. Easton. *Oil & Gas J.*, 2.7.36, **35** (7), 12–14.—Permian production has been proved at Snow Hill S.E. of Smackover. The structure is bounded on the S. by an E.–W. fault, and is entirely separated from that at Smackover.

The section in the general area varies considerably. There is an unconformity between the Cretaceous and the Tertiary, another between the Lower and Upper Cretaceous, and a combination of three between the Palæozoics and the Lower Cretaceous, the Jurassic and Triassic being entirely cut out. N. of Arkadelphia, the Palæozoic beds are almost vertical, and it is presumed that they dip steeply to the S., flattening out into the Arkansas "Permian Basin"; they rise again and truncate against the igneous intrusion of N.E. Louisiana. It is thought that the truncated Permian on the N.W. and S.E. edges of this basin, overlain by the impervious Lower Cretaceous, would form ideal traps similar to those in the Oklahoma City field. In the main basin local structures, such as faults, would provide similar accumulations to that found at Snow Hill.

The Monroe Fault is probably the eastern limit of Permian production in N. Louisiana, though farther N. in Arkansas the truncated edges of the Permian may be productive. West of the Monroe–Amity Fault system in the Sabine Uplift area, production may be obtained from the uplifted Permian at depths of about 10,000 ft.

Geological and geophysical work in the area is rendered very difficult owing to lack of information and the presence of swamps and other difficult country. It is suggested that the 700-ft. anhydrite section would offer a consistent reflection surface for geophysical work once the velocities of the adjacent beds have been determined.

J. A. G.

553.982 : 553(94)

861. Review of Recent Work in Australian Oil Search. A. Wade. *Petr. Times*, 13.6.36, **35**, 753–754.—Search for oil in Australia is now practically confined to the more or less folded margins of the four artesian or sub-artesian basins and the main coal-field area of New South Wales. These are the Great Artesian Basin of eastern central Australia with sediments ranging through the Mesozoic; the Desert Basin of northern Western Australia with Devonian to Jurassic beds; the North-West Basin of the western fringe of Western Australia with Permian to Tertiary beds; and the Gippsland Basin of South-Eastern Victoria with Oligocene to Pleistocene beds. Most of these areas have some well-authenticated evidences of oil or gas, and the age of the sediments and the structures make the North-West Basin attractive.

Along the northern and north-eastern margins of the Desert Basin run massive reef limestones of Devonian age, and within the depression are glacial deposits probably of Lower Permian age. Above come freshwater, marine, estuarine and finally freshwater beds of Middle and Upper Permian, and Jurassic age.

Numerous bores from a few hundred feet to over 3000 ft. have been sunk in various parts of the Kimberleys, and small shows of oil and dry gas have been met. The structures drilled have been pronounced, with high dips and much fracturing. However, detailed work has revealed broad low domes in the upper beds on going away from the influence of the zones of maximum diastrophism. G. D. H.

553.984

862. Character of Oil-Sand may Change Between Wells in the same Field. T. F. Smiley. *Oil & Gas J.*, 18.6.36, **35** (5), 59.—A few oil-fields are generally supposed to have virtual uniformity of sand, such as Bradford, Pa., but even in that field variations are found. Oil-sands range from loose unconsolidated beds approaching a beach sand up to hard and compact rocks such as a building stone. Sand grains vary from a microscopic size to as large as pebbles; they may be angular or well rounded, of uniform size, or variegated. The sand may be free of silt material or natural cement, or the interstices may be almost entirely occupied by such material. The porosity varies from more than 40% to less than 10%. An oil-sand may consist of many layers of different texture. In reality what is generally understood as an oil-sand is a group of sands frequently separated by more or less impervious shale layers. These shale partings may be so thin that they are not noticed in drilling, but will separate locally one petroliferous bed from the other as effectually as though they were feet thick. In drilling it is frequently found that a difference of a few inches will make a tremendous difference in the capacity of a well.

The texture of an oil-sand or one of its layers is seldom, if ever, the same throughout a field. Cross bedding, lateral variation from loose to tight sand, lensing out into shale bands are some of the causes of the liquids or gases travelling between wells by the most erratic paths. B. F. N. M.

Geophysics.

55.083 : 55(794)

863. California Operators Making Wider Use of Geophysical Instruments. T. F. Smiley. *Oil & Gas J.*, 18.6.36, **35** (5), 59.—Geophysical exploration has steadily increased in California during the last few years. All the large companies are obtaining basic data or confirming geological reports by this method. About 80% of the geophysical work has been done in the San Joaquim Valley. The use of geophysics has not attained to that reached in the Gulf Coast area, and the first oil-field discovered in California by geophysics is the Rio Bravo recently opened in Kern county. Several dry gas fields have been discovered by seismological surveys. Almost all geophysical work during 1934–35 in California was of the reflection seismograph type. No torsion balances or resistivity methods were used after the latter part of 1934. There were 15 reflection seismograph crews working in California in 1934 and 21 in June 1935.

The reflection seismograph is especially adaptable on the floor of the San Joaquim Valley, as, being removed from the influence of alluvial fans and with the water table at comparatively shallow depths, excellent reflection records can be obtained. In Californian areas, where only one very hard stratum is known in the geological sequence overlaid by a comparatively soft series of rocks, the correlation of reflection records is relatively simple. In some cases there are many strata which act as good reflectors, and the correlation becomes more complicated. The complexity increases in proportion to the number of reflecting beds and their degree of uniformity in reflecting efficiency. B. F. N. M.

553.962

864. Movements of Ground Water. O. E. Meintzer. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 704–725.—A lack of contact between ground-water hydrologists and petroleum geologists and technologists has existed in the past. Ground-water hydrology is an older science than the physics of petroleum, and is on a broader foundation, but in recent years intensive work in petroleum physics has gone far beyond comparable work in hydrology, but petroleum geologists should have given the same serious attention to hydrology that they bestowed on palæontology, petrology and mineralogy. More attention should be given to the mechanics of natural fluids, *i.e.* the geophysics of water, oil and gas.

The fundamental law of movement of water through capillary openings was promulgated by the French hydraulic Engineer Darcy in 1856. A great amount of work has been done recently to support the essential accuracy of this law, because some hydrologists have maintained that under low gradients the rate of flow may become

disproportionately low or cease altogether. The author discusses and describes various tests made by N. D. Stearns and himself by means of a simple apparatus (9 figures, 2 tables and formulæ). The results of some 1000 tests proved that the movement of water through formations having capillary openings is generally laminar and obeys Darcy's law down to very low gradients, having coefficients of permeabilities ranging from 0·001 to 90,000, indicating probable velocities ranging from a fraction of a foot to a few miles in 1 year. The Thiem field method is also briefly described, and pronounced as giving promising results for determining permeability. Movement through sub-capillary openings is important, but not well understood. Molecular attraction of the water strongly resists movement and compression.

The tendency of water in rocks is to move from an area of high pressure to one of low pressure, both along and across the permeable strata. Under water table conditions pressure changes have much more lag than under artesian conditions, due to the transfer of water that is involved. Oil wells are somewhat similar to water table wells in the development of cones of depression.

Underground reservoirs may have essentially static conditions of water or oil when the reservoirs are (1) completely sealed, (2) sealed at one end, or (3) contain fluids which differ in specific gravity, even fresh and salt water. B. F. N. M.

Drilling.

622.24.051

865. Development of Rotary Drill Pipe. H. W. Graham. *Drilling and Production Practice*, 1935, A.P.I., 162.—The first form of rotary drill pipe was welded commercial pipe, but early in the use of this system commercial pipe was replaced by seamless tubes. The introduction of seamless tubes was followed in rapid steps by increasing carbon content and tensile strength, concurrent with interior upsetting. Upsetting introduced weaknesses which can be eliminated by full-length normalizing of the drill-pipe tube. The threaded connection of drill pipe to tool joint is responsible for many failures, in that the thread acts as a notch in the root of which a crack progressively deepens under conditions of corrosive fatigue. This type of failure can be overcome by eliminating the threaded connection by forging an upset on the drill pipe to act as a tool joint. W. W.

622.24.051 : 669.1

866. Wrought Iron. J. Aston. *Drilling and Production Practice*, 1935, A.P.I., 226.—The advance in the manufacture of wrought iron from its beginning thousands of years ago up to the present time is traced. Numerous changes and developments have occurred during this time, but the product has consistently maintained certain fundamental properties. Purity of base metal, and more particularly the inclusion within this matrix of an iron-silicate slag, have been basic characteristics of wrought iron in contrast with other ferrous-metal products. To this slag is ascribed a retarding influence to the direct progress of corrosion, and an ability to lower stress concentration and obstruct the path of incipient fatigue failure.

The properties and present-day production methods are discussed in detail. There has been much effort expended to meet the economic aspects of competition and to bring about expansion in variety of marketable products. This effort has been applied mainly along the line of so-called mechanical puddling. A brief description of this process, which has had a large commercial development, is given. W. W.

622.24.051 : 669.14

867. Fundamental Characteristics of Alloy Steel. E. S. Davenport. *Drilling and Production Practice*, 1935, A.P.I., 209.—The elements of the metallurgy of alloy steels are discussed briefly, in as simple terms as possible. Technical terms are defined in an appendix. The author believes that there are a small number of fairly simple basic principles which determine the behaviour and properties of any steel, and that a proper grasp of these principles is necessary if steels are to be selected and used intelligently over the very wide range of conditions of actual service. The most important of these principles are outlined and illustrated. W. W.

622.24.051 : 669.14

868. Manufacture and Characteristics of Carbon Steel. H. W. Graham and J. H. Flaherty. *Drilling and Production Practice*, 1935, A.P.I., 190.—The manufacture of steel begins with iron-making, which consists of reduction of the iron-oxide ores into metallic iron containing as impurities an appreciable percentage of metalloids. The steel-making proper involves the oxidation of the metalloid impurities, the greatest possible degree of elimination of the resulting oxides, and the adjustment of the carbon content and the alloying of added elements with the steel to produce in the finished product the required characteristics.

The characteristics of steel are a function of the behaviour of carbon and other elements with respect to the various allotropic forms of iron under various thermal conditions. This behaviour results in varied characteristics evident in the size and distribution of various phases and constituents in a microstructure. These characteristics, in turn, impart physical properties measurable in terms of strength, ductility, hardness and similar standards. W. W.

622.248

869. High-pressure Gas Sands in Eastern Fields Necessitate Use of Rotary. R. C. Conine. *Oil & Gas J.*, 20.2.36, **34** (40), 15.—In the Oriskany gas-sand fields of Penns and New York, cable-tool drilling has been the usual practice. High gas pressures up to 2600 lb./sq. in. have been encountered, causing blow-outs and fishing jobs. To avoid these difficulties rotary methods are being resorted to, cable tools being used initially, the well then being cased and cemented. Rotary equipment is then used to finish the well. L. V. W. C.

622.243.54

870. Circulation Losses. R. Silent. *Oil Weekly*, 22.6.36, **82** (2), 24.—The loss of fluids from the holes of drilling oil wells acquires greater importance in the case of rotary drilling than in the older cable tool work, since mud control is so vital to the rotary system. Therefore it is now essential that some knowledge of the formation into which the fluid is absorbed must be acquired to combat serious loss of drilling mud. The intense study of sand porosity and effect of its grain size has consequently been undertaken. The author then details a mathematical consideration of the relations of the spherical sand grains of uniform diameter to the pore space (illustrated by 3 diagrams) and directs attention to a "Mud Performance Testing Machine" which indicates that the thickness of mud cake deposited on the walls of the hole, as also the amount of fluid which enters the stratum from the drilling, can be controlled.

Clear water will enter the pore space of any sand freely, and will follow the capillary flow and resistance laws. When water gets into a sand the tension of the surface film of water surrounding each sand grain resists breakdown and makes the flow of oil and gas through such affected surfaces extremely difficult. A 3–5% colloidal material, such as bentonite, added to the drilling fluid, will form an almost impervious cake on the walls of a hole, and practically prevent the fluid, or water from it, from entering the sand.

A description of actual experiments made in certain wells of the Middle Dome area, Kettleman Hills field, is then given. The paper concludes by recalling that, as circulation losses occur through the interstices of sand grains, the size of such pore spaces is important. Generally, such pore spaces are practically capillary in their dimensions. Losses of the circulation fluid are more important than the loss of all or a portion of the drilling fluid, because such losses would probably ruin the ultimate productivity of an oil-sand receiving the fluid.

However, due to the capillary size of the pore spaces, they can be blocked by a small amount of colloidal material deposited in the mouths of the capillary tubes comprising them, this blocking forming an impervious seal against fluid saturation, both protecting the formation from contamination and preventing loss of the fluid itself. The actual penetration of such material is very slight, and has been found to be readily removable on reversal of the pressures. B. F. N. M.

622.243.7

871. Value of Oil-Well Surveying and Applications of Controlled Directional Drilling. J. D. Hughes. *Drilling and Production Practice*, 1935, A.P.I., 60.—Briefly outlines

the value of constant surveys to determine verticality of well bore and discusses controlled directional drilling, how accomplished and where used. W. W.

622.33

572. **Handling Hot Mud Problems in Rodessa Field.** L. G. E. Bignell. *Oil & Gas J.*, 20.4.36, **34** (50), 26.—Hot mud provides one of the major problems in the drilling of wells by rotary in the Rodessa, La., field. The sub-surface temperature ranges from 100° F. near the surface to 140° F. at 5000 ft. At this depth the first anhydrite is penetrated, and the temperature increases rapidly, the mud fluid being heated to as much as 190° F., when the drill enters the gas formations at about 5500 ft. Concern was felt about the effect of the heat on the cement used in setting the casing. By rapid placement and the use of large quantities of ice for chilling the mixing water, good cementing jobs were performed. By enlarging the size of hole for the 7-inch casing, the pressure required to place the cement has been reduced, and this has eliminated the need for ice during the winter. The natural mud provided by the formations is generally used, the viscosity and weight being adjusted by the admixture of barytes and aquagel. The salt encountered in the anhydrite formations lowers the viscosity of the mud, reducing its carrying capacity, with consequent deposition of cuttings. Another feature is the tendency of the mud to dry out, especially if aquagel is used in excess. In some cases the mud has been found caked behind the pipe. Where sufficient space is available for the construction of the usual type of mud ditch and pit, the hot mud cools before it reaches the suction pipe of the slush pumps. Where space is limited, or in order to economize on the excavation of pits, the mud is sprayed from casing lines or wooden plumes, being cooled by evaporation. Vibrating screens are frequently used for the removal of the cuttings. L. V. W. C.

622.323 : 614.445

573. **Stream Pollution Hazards Minimised by Improved Salt Water Disposal.** H. K. Ihrig. *Oil & Gas J.*, 23.4.36, **34** (49), 51.—While it has been the practice in past years to dispose of salt water by dumping into the natural drainage, other methods of disposal are being investigated to prevent damage by water contamination. Ordinarily an oil-producing structure cannot be drained without producing large quantities of salt water. In certain areas where the salt water produced was formerly put into surface drainage, there is no salt water apparent. Input wells have been drilled to either non-producing formations or on the low side of producing structures, and the salt water is returned to these formations. In such a well the salt-water line from the settling tanks is connected to the top of the casing in the well; the casing being cemented from top to bottom to protect the water-sands penetrated. The well may take water without the aid of pumps if the formation is dry and sufficiently porous; but with low-porosity sands pumping is necessary in order to force the water into the formation. In order to combat corrosion in the gathering system lines cement pipes are being used. L. V. W. C.

622.245.2 : 608.3

574. **U.S. Patents on Drilling Plant, etc.** A. A. Mels. U.S.P. 2,041,720, 26.5.36. A well bailer including swabbing device acting as a piston inside the bailer and means for dislodging the bailer when it sticks without moving the swab.

622.245.2 : 608.3

E. C. Hyde and J. C. Renfro. U.S.P. 2,042,103, 26.5.36. An apparatus for heating and treating oil wells, comprising a shell containing substances which react exothermally on the addition of water.

622.276.4 : 608.3

W. H. Graham and W. S. Grace. U.S.P. 2,042,336, 26.5.36. Deep well pump.

622.245.1 : 608.3

W. N. Thompson. U.S.P. 2,042,745, 2.6.36. Tubing heat.

622.245.62 : 608.3

J. A. Wilcox. U.S.P. 2,042,817, 2.6.36. A liner washer consisting of a pair of spaced packers which can be compressed and expanded so that a seal is formed on each side of the openings provided.

622.276.4 : 608.3

W. L. Forward. U.S.P. 2,042,933, 2.6.36. A rotary pump with a venturi tube interposed in the column and provided with pressure taps and a pressure indicator at the surface.

553.984 : 608.3

A. L. Armentrant. U.S.P. 2,043,225, 9.6.36. A method and apparatus for testing the productivity of the formation in wells.

622.245.2 : 608.3

L. C. Tilbury and G. F. Turechek. U.S.P. 2,043,340, 9.6.36. A well-cleaning apparatus operated by fluid pressure.

622.245.12 : 608.3

G. F. Turchek. U.S.P. 2,043,341, 9.6.36. Cable rope socket and method of construction.

622.243.7 : 608.3

E. K. Lane. U.S.P. 2,043,381, 9.6.36. Automatically orienting whipstock.

622.245.44 : 608.3

J. H. Reynolds. U.S.P. 2,043,492, 9.6.36. Well packer.

622.243 : 608.3

G. Blow. U.S.P. 2,043,504, 9.6.36. A method of drilling wells by filling the drill hole with a liquid of greater specific gravity than that of the formation being penetrated.

L. V. W. C.

Production.

553.982

875. Formation Volume and Viscosity Studies for Domingues Field. B. H. Sage and W. N. Lacey. *Drilling and Production Practice*, 1935, A.P.I., 141.—Experimental studies have been made to determine the volume occupied by various mixtures of an oil and a gas obtained at the surface from the production of a well in Domingues field, California, when the mixtures were brought to equilibrium at various temperatures and pressures which might be met in production practice. The data presented can be used to illustrate the changes in fluid volume and to indicate what volume a unit quantity of crude oil at the surface of the ground and the gas produced with it most probably occupied in the sands of the oil formation. Corresponding values for the solubility of the gas in the oil are also included.

Experimental determinations of the viscosity of the liquid portion of these same mixtures have been made throughout the same ranges of temperature and pressure.

W. W.

553.982

876. Permeability Measurements of Oil-Sands Important Factor in Determining the Methods for Repressuring. H. M. Ryder. *Oil & Gas J.*, 30.4.36, **34** (50), 28.—For repressuring operations the most important physical measurement of the sand properties is permeability. Porosity and saturation are important for determining whether the sand is worth repressuring. Permeability is a measure of the fluid conductivity of a sand. In repressuring permeability measurements enable the estimation of well spacing, medium and pressures to be used, strata to be eliminated, and the selection

of glycerin shells for shooting in order to equalise variable rates of flooding. Precise fluid flow measurements of permeability necessitate specimens cut from cores. These measurements, although accurate for the specimen, owing to lack of homogeneity in the sand, may be misleading. A method has been developed in which permeability is correlated with grain size. The procedure is described in detail and a formula given for calculating the permeability. Permeability in millidarcies $= 100\left(\frac{L}{L+\frac{S}{4}+4B}\right)^4$ where L = weight of all sand on 140-mesh sieve and all larger mesh sieves, S = weight of sand on 325-mesh sieve, B = weight of sand on bottom. This formula has been developed for the sand types found in the northern part of the Bradford field. Variations in grain size and cementing material may necessitate modification of the formula.

The permeabilities of a core from the Bradford field as determined by the grain-size calculation and the fluid flow method show marked similarity. L. V. W. C.

622.245.52

877. Shooting Probably does not Produce a Large Cavity at Bottom of Well. T. F. Smiley. *Oil & Gas J.*, 18.6.36, **35** (5), 59.—General belief nowadays is that explosion of a nitroglycerine charge does not make a large cavity at the bottom of a well. It has often been shown by an oil-sand reamer run into a well after a shot that the bottom of a hole is only slightly larger than the bit used in drilling. The direction of the explosive force is probably mostly towards the surface. If, however, the reservoir rock is limestone, then channels and openings in it may be in or near the walls of the well, and the explosion may break through into them and bring in a gusher. Solidified nitroglycerine is slower in its action and its disruptive range wider. No data are available to show the disruptive range of any explosive in any specific stratum.

B. F. N. M.

622.276.2

878. Pressure Maintenance. B. Mills. *Oil Weekly*, 22.6.36, **82** (2), 19.—The South Burbank field, an extension of the old Burbank field discovered 10 years ago, is geologically similar to it. 120 wells have been drilled in it since late in 1933. Rapid development of the old field had resulted in excessive waste of oil and gas, and, due to the pressure decline, the field had been reduced to a pumping condition much earlier than need have been. It was calculated that an increased recovery of oil of from 25 to 40% would have been made had pressure maintenance been installed.

In 1935 a combination of 17 principal leaseholders agreed on a unit operating plan on the S. Burbank field. A total of 2700 acres formed the unit, with 90 producing wells varying in depth from 2800 to 2900 ft., with original bottom pressure of from 1050 to 1100 lb. The drilling programme is 1 well to 18 acres, subject to modification according to the response to the maintenance of pressure. Six input wells have been drilled. Analysis of pressure conditions, porosity and thickness of the producing sand, location of the input wells, gas volume and changes in the gas–oil ratio in all parts of the field has been instituted. South Burbank is not affected by sustained water drive, the chief producing energy being derived from free gas and oil dissolved gas. The fear of sharply affecting the gas–oil ratio has precluded the injection of enough gas to maintain the full formation pressure from month to month, but sufficient gas is returned to the producing stratum to give a more uniform formation pressure, a slower pressure decline and the recovery by flow of an increased percentage of oil over that obtained by the old methods. In less than 1 year 1500 million cu. ft. of gas has been injected. The bottom-hole pressure is increasing, declining or remaining almost constant in different parts of the field. The average pressure for the field is falling slowly, being about 5 lb. in the last 5 months. The gas–oil ratio averages 1/1000. The producing wells have 2- and 2½-inch tubing, but the injection wells are untubed and gas is injected through 7-inch casing.

The pressure programme has demonstrated the importance of the weight of a column of gas under pressure, in that when the surface pressure and the bottom-hole pressure are identical, the weight of the gas column alone may supply the required pressure excess over the surface pressure to cause the stratum to take the gas, but, in practice, a higher surface pressure is advisable. B. F. N. M.

Pipe-Lines.

622.698 (567)

879. Irak Pipe-Line from Mosul to the Mediterranean. Anon. *Rev. Comb. Liq.*, June–July 1936, **136**, 208–210.—This article is based on an address by M. Maurice Mercier, Secretary General of "La Compagnie Française des Petrole" to the "Société Royale de Géographie d'Anvers," presenting the progress of the Irak Petroleum Co. from its inception to the present time. The Irak Petroleum Co. is an international organization which has achieved, in 12 years of amicable collaboration, an astounding success in spite of the general belief that the international contracting parties were animated by rivalry of sentiment. The progressive capitalization of this Company, of its subsidiary, the Mediterranean Pipe Line, Ltd., and of La Compagnie Française is given, that of the last named now amounting to 1000 million fcs.

Coincident with the mobilization of capital, technical activity in the nature of geological expeditions was undertaken from 1919 to 1926, on the completion of which a drilling programme was drawn up. The first agreement between the Government and the Company allowed the latter 2 years on which to choose 24 perimeters each of 64 square miles, permitting the testing to be done on a scattered plan, so as to insure the finding of the greatest possible number of favourable structures. Twelve drilling outfits were used, and exploration did not wait on road, water and telephone connections. At the end of 1926 there were 2564 employees at work, of whom 130 were Europeans. Drilling began on 10 different structures: at Palkanah Nos. 1 and 2, Kahm el Ahmer, Injanah, Baba Gurgur, Quaiyarah, Tarjil and Jompur, starting up in April, May, June, July and August 1927. Karmor and Khaimqah would have been undertaken by 1928, but in October 1927 No. 1 Baba Gurgur struck a big gusher at a depth of 463 metres, much shallower than the geologists predicted, and changed entirely the exploration campaign. The well, uncontrolled, flowed at the rate of 12,000 tonnes a day for 3 days, and was then got under control. This pointed to a huge oil reservoir under the Baba Gurgur anticline, which was given intensive study to determine its extent, which was eventually fixed at 90 km. in length with an average width of 3 km. Each well drilled with this object having been successful, the test wells on the other structures were one by one shut down, and in the revised concession of 90,000 sq. km. they represent the future reserves. Baba Gurgur, now named Kirkuk, had, at the end of 1933, 42 producing wells. It is claimed to be the greatest deposit of oil in the world in single ownership, even if compared with Baku or East Texas. The Company immediately started the pipe-line to transport 4,000,000 tonnes of oil/year as stipulated in the agreement, which is now assured of delivery by only 15 out of the 42 drilled producing wells. The question is now asked, What will be the consequences to the world and to Europe of marketing the Mosul oil? The double pipe-line pours out daily on the world's markets 80,000 brl. of oil, a little more than New Mexico, U.S.A., produces, half of what Kansas supplies, and about the figure of the average variations of daily U.S.A. production from week to week. Consequently this addition to the world's oil resources cannot greatly disturb the equilibrium of the industry, as some prophets have foretold. B. F. N. M.

622.698 : 620.197

880. Effect of Corrosion on Coated and Uncoated Pipe-Lines. Anon. *Petr. Eng.*, June 1936, **7** (9), 51.—The effect of corrosion on coated and uncoated pipe-lines is illustrated by data recently compiled by 3 major pipe-line companies on the condition of 118 miles of 8-inch screwed pipe laid in 1917 in approximately the same areas in Northern Texas and Southern Oklahoma. Of the unprotected pipe 46·12% was acceptable for use without spot welding, 18·02% was acceptable after spot welding, 24·76% was usable but was not sufficiently high grade for shipping to lay in new line and 8·37% was regarded as junk. Three different lines protected with asphalt, and saturated felt showed the following recovery figures:—Pipe acceptable for use without spot welding, (*a*) 87·7%, (*b*) 86·52%, (*c*) 96·62%; pipe acceptable after spot welding, (*a*) 5·85%, (*b*) 6·63%; junk, (*a*) 3·75%, (*b*) 4·20%, (*c*) 0·36%. C. L. G.

622.698 : 620.197

881. Instruments for Locating Coating Faults and Corroded Areas on Pipe-Lines. A. L. Smith. *Petr. Eng.*, June 1936, **7** (9), 49.—A description is given of the Faulto-

meter, used for locating faults in pipe-line coatings and corroded areas in uncoated pipes, as well as areas of corrosive soil. Readings are taken of the flux density in the ground above the pipe, the current being obtained from a high-frequency portable generator, which makes contact with the pipe-line and with a ground rod some distance away. Leakage of current from the pipe at abrasions and faults is indicated by the flux density above the line, which is measured by the instrument. Sensitivity is very high, and can be controlled in arbitrary steps. The same procedure is used for determining corroded areas in uncoated pipe, the differential between non-corrosive and corrosive soils being a little less than between an abraded and a well-coated area. When testing for corrosive soils, two ground rods placed parallel to the pipe-line right of way, and spaced 10 ft. or more to either side, are used, and readings are taken every few feet.

The Faultometer is also used for determining the most suitable location for ground-beds used for cathodic protection, it having been found that the ground-bed for the positive side of the current should be placed opposite the best-coated section of the line, in order to obtain the utmost distribution of current and to prevent extreme saturation of current opposite the ground-bed.

The instrument can be used to detect leaks in pipe-line owing to the insulating effect of the escaped oil on the pipe-line as compared with the bare pipe. A possible application of the Faultometer is the determination of the geologic nature of the strata, thus eliminating continuous coring in the drilling of a well. C. L. G.

622.698 : 620.197

882. Methods of Combating Corrosion and Electrolysis of Underground Lines. V. J. Sittel. *Oil & Gas J.*, 23.4.36, **34** (49), 46.—Field surveys have shown that underground pipe-lines have currents flowing in them, varying from micro-amps. to 200–300 amps., according to the soil condition and locality. These currents are caused by external potentials impressed on the pipe-line, and may be classified as (*a*) currents produced by the galvanic action of the soil to iron pipe, and (*b*) stray currents flowing through underground pipes as return currents from electrified railways and industrial power circuits. The first class of currents produce the major portion of electrolysis corrosion with which pipe-line companies have to deal. Pipe-lines are exposed to different soils containing different chemicals and percentages of moisture. The pipe-line may be considered as a series of galvanic cells generating and discharging currents between different soil areas. Electrolysis corrosion occurs where the currents pass from the pipe to the soil, iron being carried with the current and deposited in the soil. Pipe-lines can be protected from corrosion by reconditioning the pipe, cleaning, wrapping and coating with different asphalt dopes. This is the insulation method, but fails whenever a fault in the coating occurs and allows moisture to enter. Cathodic protection is a method increasingly used, especially where rural electrification makes power available at low costs for force-drainage systems. To effectively protect a pipe-line with forced drainage or cathodic protection, the line should be maintained at 0·3 volt negative to the soil, so that currents cannot flow from the pipe to the soil. To maintain this negative potential a forced drainage system is constructed along the line. Direct current is fed into the soil through ground beds and drained off the pipe-line through the negative terminal. Several companies are installing windmill generators to furnish the electrical power required. A 1–3 kilowatt D.C. generator will protect 1 to 2 miles of line. The generators have been developed to start on a 3–3½ m.p.h. wind. L. V. W. C.

622.698 : 620.197

883. Inspection of Rubber Pipe-Line Coating. E. F. Schmidt. *Petr. Eng.*, June 1936, 7 (9), 33.—An examination has been made of a 100-ft. section of rubber-coated 10-inch pipe-line laid in highly corrosive soil in Texas. The pipe consisted of 5 welded sections, coated with vulcanized rubber, the joints being protected with unvulcanized rubber sleeves cemented on the pipe and extending several inches over the rubber coating, and finally wired on firmly.

The vulcanized coating was found to be in perfect condition, but the sleeves had not been tight enough to exclude water, which caused rusting and pitting of the pipe. The sleeves were removed and substituted by wrapping with Korosseal coated herring-

bone tape, previously impregnated with Koroseal solution, the uncoated pipe being first carefully cleaned and coated with the solution heated to 200° F. The wrappings were finally given three coats of the sealing solution. The section will be inspected annually. C. L. G.

665.511 : 622.698

884. Blow-Off Protection Cap Developed to Remedy Gas-Line Thieving. W. M. Sartain, Jr. *Oil & Gas J.*, 30.4.36, **34** (50), 39.—The worst troubles encountered in operating a high-pressure gas line are condensation and tampering. The first can be handled by blow-offs or drips, but these are liable to tampering. A guard cap is described which is suitable for the protection of blow-off valves. L. V. W. C.

Chemistry and Physics.

547.21 : 536.423.15

885. Hydrocarbon Vapour Pressures. E. R. Cox. *Ind. Eng. Chem.*, 1936, **28**, 613.—The vapour pressures of all hydrocarbons with molecular weights above 30, the data for which are available, can be correlated by three equations if normal boiling point and critical temperature and pressure are known. The latter can be calculated for the normal paraffin series. P. D.

547.213 : 536.782

886. Phase Equilibria in Hydrocarbon Systems. XIII.—Joule–Thomson Coefficients of Propane. B. H. Sage, E. R. Kennedy and W. N. Lacey. *Ind. Eng. Chem.*, 1936, **28**, 601.—An apparatus was designed for determining the Joule–Thomson coefficient, and tested on CO_2 and found to give reasonable agreement with published data. It was used to determine the Joule–Thomson coefficients over the temperature range 75–200° F. and at pressures up to 3000 lb./sq. in. The usefulness of this property in thermal calculations is discussed. P. D.

665.512 : 532.13

887. High-Temperature Viscosities of Liquid Petroleum Fractions. K. M. Watson, J. L. Wien and G. B. Murphy. *Ind. Eng. Chem.*, 1936, **28**, 605.—The capillary-tube method was used to determine the kinematic viscosity between 100° and 800° F. of a series of liquid hydrocarbons ranging from pure benzene and *n*-heptane to lubricating oils and products from commercial cracking units. The data can be satisfactorily expressed by the equation $\log (\log \mu/s + 1{\cdot}7) = a(t + 100) + b$, for temperatures above 210° F.

μ/s = kinematic viscosity centistokes.

On the basis of this equation a high-temperature viscosity chart was developed. A nomograph is given permitting the estimation of the viscosity temperature curve of a liquid from normal laboratory inspection data. P. D.

Analysis and Testing.

532.13

888. Theory of Viscosity of Liquids. D. B. Macleod. *Trans. Farad. Soc.*, 1936, **32**, 872.—The author proposed (*Trans. Farad. Soc.*, 1923, **19**, 6) the following equation for representing the viscosity of a liquid: $\eta = \frac{KMa}{v - b}$ where η = viscosity, K = compressibility, M = molecular weight, a = quantity greater than unity and decreasing with rise of temperature. The quantity $(v - b)$ may be connected with the internal pressure of the liquid by Van der Waals equation. From a general consideration the author proposes the equation: $\pi_0 e^{c'/2v} = \frac{RT}{v - b}$ for the change of volume of a liquid with temperature. The three unknowns $\frac{\pi_0}{R}$, c' and b can be evaluated from the known volume–temperature equation of a liquid.

Reasons are given for substituting $M_0 e^{a'/Tv}$ for Ma in the first equation given, where M_0 is the true molecular weight. This substitution allows for the degree of association of the liquid. These substitutions for Ma and $v - b$ reduce the first equation to one of the form: $\eta = \frac{Be^{a'/Tv}}{T}$ which is substantially the same as that proposed by Andrade (*Phil. Mag.*, 1934, **17**, 497, 698).

The equations derived are applied to octane as an illustrative example. P. D.

536.423.15

889. Parallel Scale Slide Rule Developed to Calculate Vapour-Pressure Data. F. J. Smith and H. P. Sharp. *Oil & Gas J.*, 14.5.36, **34** (52), 188.—A description is given of the method of construction and use of a slide rule for computing the vapour pressure of hydrocarbons up to and including heptane at temperatures from — 50° to 450° F.

The scale is based on the Cox vapour-pressure chart using as ordinate log vapour pressure (lb./sq. in.) and as abscissa the inverse of the absolute temperature in ° F. The data were taken from the International Critical Tables and from the *Refrigerating Engineer* (1926, **12**, 387). Straight lines were drawn on the chart through points representing the best data, and the levelled values arranged in the form of a parallel scale chart by constructing another temperature scale identical with the first, and laying off on parallel lines above it the data for the respective hydrocarbons as determined from the Cox chart. From this the slide rule can be easily constructed, and is claimed to give as high an accuracy as present knowledge affords, in addition to being much simpler and easier to read than previous charts. C. L. G.

541.24

890. Nomographs for Molecular Weight. W. S. Gilfoil. *Ind. Eng. Chem. Anal.*, 1936, **8**, 228.—The freezing-point and boiling-point methods of determining molecular weight are set out in nomographic form using the equations $Kf = T_0^2/503l_f$ and $m = 1000 K_f \times g/G \times \Delta T_f$, where K represents the molal depression of the freezing point; T_0 the freezing point of the solvent in degrees Kelvin; l the latent heat of fusion in cals. per gm.; G the weight of solvent; g the weight of solute; m the molecular weight of the solute, and ΔT_f the observed freezing-point depression. G. R. N.

541.459 : 665.521.2

891. Colorimetric Estimation of Peroxides in Unsaturated Compounds. C. A. Young, R. R. Vogt and J. A. Nieuwland. *Ind. Eng. Chem. Anal.*, 1936, **8**, 198–199.—The Yule and Wilson method of estimating peroxides in cracked gasoline by shaking it with an acidified solution of ferrous sulphate and ammonium thiocyanate was improved by: (i) replacing acetone by absolute methyl alcohol as the solvent, and (ii) using ferric thiocyanate colour standards in place of titration with titanous chloride. G. R. N.

542.48

892. Micro-distillation Apparatus. L. C. Craig. *Ind. Eng. Chem. Anal.*, 1936, **8**, 219–220.—A description of an adaptation of the Siwoloboff apparatus for taking boiling points of very small samples. It is claimed that by repeated distillation true fractionation can be obtained. G. R. N.

542.48

893. Glass Laboratory Bubble Cap Columns. J. H. Bruun. *Ind. Eng. Chem. Anal.*, 1936, **8**, 224–226.—A description of two all-glass buble-cap columns of improved design is given. These columns are easy to operate, and may be used for vapour velocities up to 31·3 and 65·5 cm. per second, respectively. Since the height of the equivalent theoretical plate of one of these columns is about 2 cm., it is feasible to build columns with separating powers equivalent to between 100 and 150 theoretical plates within an average height. Efficiency data on the use of these columns with binary mixtures of known compounds are given. G. R. N.

542.71

894. Determination of Moisture Content by Distillation with Liquids Immiscible with Water. F. G. H. Tate and L. A. Warren. *Analyst*, 1936, **61**, 367–381.—A modified all-glass apparatus is described based on the principle of the Dean and Stark apparatus. Aromatic hydrocarbons are considered to give unsatisfactory results, and commerical heptane is preferred as the distilling medium. The application of the method for determining the moisture in a number of products is described and the advantages of the method are summarized. C. C.

621.431.72

895. Carbon Monoxide Analyser. E. A. Means and E. L. Newman. *Refiner*, 1936, **15**, 191–192.—As the popular iodine-pentoxide method of determining carbon monoxide in air exhaust gas, etc., although accurate, is laborious, an apparatus was constructed to oxidize the gas by combustion. 80 ml. samples were used, the determination taking 30 minutes. The apparatus consisted of a combustion chamber, compensator and manometer mounted in a water-jacket maintained at a constant temperature. In the combustion chamber a shield around the filament gave constant and complete circulation. A graduated 1-mm. capillary tube partly filled with mercury, and with a screw in the reservoir for sensitive adjustment, was used to measure volume change. In analysis the sample is drawn into the combustion chamber, the pressure balanced against that in the compensator, and current is sent through the filament. After cooling, the mercury in the capillary is adjusted to balance again the combustion chamber and compensator, and the contraction noted. In experiments on samples of 0·1–0·01% carbon monoxide in air the average deviation was 0·003%.
G. R. N.

665.521.8 : 543.8

896. Determination of the Proportion of Bitumen and Tar in Mixtures of the Two. A. B. C. Licence. *J.S.C.I.*, 1936, **55**, 487–488.—When a drop of benzene is allowed to fall on a small quantity of bitumen on filter paper the colour effect is uniform as to shade, varying only in intensity, while when tar is similarly treated a zone of bright greenish-yellow shading to light orange spreads outwards, finally shading rapidly to a brownish orange. Mixtures of tar and bitumen give intermediate colour effects. For the quantitative method a few grams of material are dissolved in benzene and the solution is evaporated and dried. 0·5 gram of the residue is weighed into a metal dish and melted into a thin film. The residue is refluxed repeatedly with 60–80° C. petroleum ether free from aromatics, and the extract and finely divided solid are made up to a definite volume. The colour of the solution is compared with a set of standard solutions containing varying proportions of tar and bitumen. C. C.

542.48 : 668.3

897. Patents on Analysis. G. Deibel. E.P. 447,894, 27.5.36. Laboratory apparatus for use in distillation or evaporation operations.

543.852 : 668.3

S. Metropolitan Gas Co. and H. D. Greenwood. E.P. 448,234, 4.6.36. Apparatus for measuring acidity of gases containing So_2 or oxides of N_2. W. S. E. C.

Refining and Refinery Plant.

665.54

898. Instrumentation in Oil Refining. A. C. Proctor and G. Egloff. *Refiner*, 1936, **15**, 225–231; *Oil & Gas J.*, 4.3.36, **35** (3), 43.—An A.P.I. paper which describes the instruments used in the control of oil-refining operations and their maintenance. These instruments include various types of temperature recorders, displacement and differential pressure flow meters, various pressure recorders and controllers, liquid level controllers and control valves. G. R. N.

665.54

899. **Refinery Construction.** Anon. *Oil & Gas J.*, 21.5.36, **35** (1), 42, 47.—A list is given of the major refinery construction programmes under way or recently completed both in the U.S.A. and abroad.

It is estimated that in the U.S.A. oil refiners will spend $231,000,000 on new equipment and supplies, of which $67,000,000 is for heavy prefabricated equipment. $60,000,000 will be spent on refinery equipment outside the U.S.A., the principal item being the construction of cracking units. C. L. G.

665.54(73)

900. **Refineries Operating in the United States.** Anon. *Oil & Gas J.*, 19.3.36, **34** (44), 164.—A list is given of the refineries in the U.S., with the crude oil capacity, gasoline capacity, type of refinery and cracking plants available in each case. C. L. G.

665.54 : 614.445

901. **Controlled Disposal of Wastes *vs.* Pollution.** W. B. Hart. *Refiner*, 1936, **15**, 232–235; *Oil & Gas J.*, 14.5.36, **34** (52), 233.—A general discussion on how pollution starts, controlled waste disposal, refining and pollution, and economic and legislative problems concerning this subject of public importance. The major wastes in the petroleum industry are waste oils and emulsions, spent caustic, acid water and acid sludge. If their disposal is well controlled, any stream receiving the resultant waste water will have ample opportunity to retain all its value. G. R. N.

665.542.23.094.8 : 661.322.1

902. **Recovery of Caustic Soda.** Y. S. Susanov. *Neft.*, 1935, **6** (4), 19.—Sodium hydroxide may be recovered from alkali sludge by heating the latter with calcium hydroxide and gas oil. In the reaction two layers are formed, the lower the caustic soda and the upper the naphthenic soap solution in gas oil. The caustic soda does not need any additional treatment, while the naphthenic soaps are converted into acids by treatment with sulphuric acid. For. Petr. Techn.

66.048.28

903. **Heat Exchangers.** V. O. Marshall. *Refiner*, 1936, **15**, 147–156.—A simple exposition of the heat equations involved in the design of heat exchangers is given, together with 21 diagrams of heat exchangers and their parts which are described in short notes. G. R. N.

66.048.28

904. **A Horizontal Film-Type Cooler.** F. W. Adams, G. Broughton and A. L. Conn. *Ind. Eng. Chem.*, 1936, **28**, 537.—Fundamental data were determined in a study of the factors affecting film coefficients of heat transmission for water films on the outside of a horizontal pipe-cooler in an experimental set-up. These data cover the commercial range of operating conditions for a type of cooler on which no adequate design data were previously available. Water velocity and pipe diameter are the main factors controlling the magnitude of the coefficient. Variation of film temperature from 146° to 196° F. gives no alteration in the coefficient. The results are correlated by the equation

$$L_0 = 24{\cdot}4\,\frac{C^{0{\cdot}29}}{D^{0{\cdot}71}}.$$

L_0 = B.Th.U./hr./sq. ft./° F.
C = rate of flow of cooling liquid lb./hr./ft.
D = outside diameter of tube, feet.

This equation applies for 2-inch and 4-inch pipe. 1-inch pipe gives figures about 80% of those calculated. P. D.

66.048.22

905. Mean Temperature Difference in Multipass Heat Exchangers. R. A. Bowman. *Ind. Eng. Chem.*, 1936, **28**, 541.—The writer reviews the literature and finds no equations available for shells with more than two passes. An equation is derived for extending the results given by Nagel (*Ind. Eng. Chem.*, 1933, **25**, 604) to exchangers with any number of passes. A table gives solutions of this equation for 2-, 3-, 4-, and 6-pass shells. P. D.

66.048.23

906. Heat Transfer Coefficients in Vertical-Tube Forced-Circulation Evaporators. N. Fragen and W. L. Badger. *Ind. Eng. Chem.*, 1936, **28**, 534.—A large number of over-all heat transfer coefficients in forced-circulation evaporators were correlated by the equation :—

$$U = \frac{435u^{0.45}}{\mu^{0.25}\Delta t^{0.1}}$$ where U = over-all coefficient based on mean area of heating surface, B.Th.U./sq./ft./hr./° F.; u = linear velocity of liquid at tube entrance ft./sec.; μ = viscosity of solution lb./hr./ft.; Δt = over-all apparent temperature difference.

Another equation is derived containing terms for tube length and diameter, but is based on too few determinations to have much weight. It is

$$U = \frac{490D^{0.57}\mu^{2.4/L}}{\mu^{0.25}\Delta t^{0.1}}$$ where D = arithmetic mean diameter of tubes in inches; L = tube length, feet. P. D.

66.048.23

907. Vapour-to-Liquid Heat Exchangers and Condensers. R. H. Turner. *Petr. Eng.*, May, 1936, **7** (8), 23.—The mechanical features in the design of vapour–liquid heat exchangers and condensers are discussed. Unimpeded draining of the condensate in gasoline condensers is obtained in single-pass vertical units, resulting in increased efficiency owing to the condensate covering the outsides of the tubes to their full extent. Multipass condensers of this type tend to result in temperature crossing (local higher temperature of cooling medium than gasoline). Placing units in parallel requires excessive structural fittings and connections, so that a battery in series is generally used. Protecting plates conforming to the curvature of the shell and directly exposed to the incoming vapours should be perforated with holes so as to utilise as far as possible the protected cooling surface and diffuse the incoming vapours. In the design of this type of equipment a consideration of the kind of vapours to be treated and of the amount of condensate formed is more important than that of the type of baffle to be used. The increase in heat transfer rate of 100% cross-tube flow over 100% parallel-tube flow, due to the decreased travel of the vapours, with a lower pressure drop, can be computed from a formula given. A typical example gives a theoretical factor of 1·80, but 1·5 is about the best that can be obtained in practice.

Descriptions are given of the disc and doughnut (or solid and ring) half-moon, orifice, and single and parallel horizontal type baffles. The orifice type baffle is claimed to give the greatest amount of turbulent flow with the minimum of pressure drop. The parallel baffle type is very efficient, particularly in 2-pass liquid-to-liquid units of an exceptionally great tube length. The space between the parallel baffles becomes filled with stagnant vapour or liquid which has no heat transfer rate for cross flow of heat. C. L. G.

66.048.23

908. Thermodynamics of Vapour Heat Exchangers. R. H. Turner. *Petr. Eng.*, June, 1936, **7** (9), 110.—In computing the total heat to be extracted in a vapour condenser and cooler, the heat can be split up into: (*a*) sensible heat from vapour cooling, (*b*) latent heat from vapour condensation, (*c*) sensible heat from condensate cooling, (*d*) sensible heat from steam vapours, (*e*) latent heat from steam condensation and (*f*) sensible heat from water cooling.

A hypothetical cooling problem is worked out, it being assumed that the oil vapours are cooled to, and then condensated at, their 50% boiling-point temperature, whilst

the temperature at which steam condenses is calculated from the inlet vapour pressure. From a consideration of graphs giving the amount of heat absorbed by cooling water at different temperatures from different vapours and condensates, the percentage of the total heat required for each particular duty can be calculated. The correct heat transfer rate for each duty is then determined, and from this the design of the equipment to suit the particular conditions of the problem in question is evolved.

C. L. G.

66.048.3

909. Effect of Entrainment on Plate Efficiency in Distillation. A. P. Colburn. *Ind. Eng. Chem.*, 1936, **28**, 526.—The effect of entrainment in a plate column used for distillation or absorption is to reduce the apparent plate efficiency. This efficiency, Ea, can be calculated from the approximate equation: $Ea = \frac{Ev}{1 + \frac{eEv}{R}}$ where :—

Ev = Murphree efficiency; e = mols. of entrained liquid per mol. of vapour; R = reflux ratio.

If it is assumed that $e \propto v^4$, where v is the vapour velocity, it is found that, at the optimum velocity for a column

$$e = R/3Ev.$$

This value is high, and indicates that it is logical to design columns with higher vapour velocities than is normal. If this is done, attention must be paid to increasing the sizes of vapour chimneys and liquid downpipes, and these should be made sufficiently large even in a column designed for operation at comparatively low velocities so that the velocity can be increased if desired. P. D.

66.048.58

910. Heating and Cooling Rectangular and Cylindrical Solids. A. B. Newman. *Ind. Eng. Chem.*, 1936, **28**, 545.—This paper deals with surface and central temperatures as functions of time in cases of heating or cooling solids of various shapes by convection.

Schack's charts for the infinite slab are reproduced, and an additional pair of charts for the infinite cylinder presented. It is shown how these charts, used singly or in pairs, may be applied to estimate the surface and central temperatures of finite shapes such as rectangular bars, brick shapes, short cylinders, etc. P. D.

Cracking.

66.092

911. Two-Stage Combined Cracking Unit. M. M. Karasik. *Neft.*, 1935, **6** (12), 14–15.—In the new cracking unit developed by the Nefteproekt the stock is pumped through heat exchangers to the upper plate of the flash-tower (auxiliary evaporator) for dehydration, then into the first bubble tower (when working for boiler fuel). When working to produce bunker fuel, 25–30% of cracked residue obtained in the vacuum evaporator (flashing) are added to the stock. The oil is heated in this tower by direct contact with the vapours (420° C.) passed through the lower part of the tower. Here the lighter products evaporate, and are passed together with the lighter cracked vapours (boiling below 350° C.) into the lower part of the second bubble tower. The heavy part is taken up from the bottom of the first tower (fraction boiling above 350° C.) together with the recycle stock (350–420° C.), and passed into the light cracking coil (20–25 atm. pressure and exit temperature 450–470° C.). Vapours from the first bubble tower, on entering the second, are separated into P.D. vapours and gas, which leave (at 200° C.) through the top of the tower, and liquid (200–350° C.) taken up by a hot oil pump from the bottom is passed to the severe cracking coil operated at 35–40 atm. pressure and 500–520° C. The cracked products from both coils are mixed, flashed with light condensate ex the lower section of the second bubble tower and circulated in the stabilizer reboiler, heat exchangers and the absorption tower. The mixture enters (at 420° C.) the lower section of the evaporator, where the fraction boiling below 420° C. leaves in the form of vapour and enters the first bubble tower, whilst the residue passes to storage via flash coil and cooler. The pressure distillate and gas are stabilized in the usual manner. For. Petr. Techn.

Hydrogenation.

66.094.1

912. Combined Pyrolysis and Hydrogenation. N. S. Butkov and E. I. Rabinovich. *For. Petr. Techn.*, 1936, **4** (3), 102; **4** (4), 143.—After extensive experimental studies it is concluded that the combined pyrolysis and hydrogenation process may be characterized as follows: In the pyrolysis of any kind of petroleum product 48% tar and 50% gas are obtained. The pyrolysis tar is hydrogenated, whereby the lighter tar fraction is subjected to a stabilizing hydrogenation while the tarry residues pass through a destructive hydrogenation. The yield of hydrogenated gasoline is 40%, *i.e.* 18% from stabilizing and 22% from destructive hydrogenation. Hydrogen may be obtained from the pyrolysed gases, but it is preferable to further pyrolyse these gases, so that the higher olefines present are converted into aromatics (70%) and ethylene (30%). By this means a gas containing 22% ethylene can be obtained. The final yields from the combined process are 46% gasoline (octane number 82-84), 15% ethylene and 39% gas (chiefly methane and hydrogen). G. R. N.

66.094.1 : 665.3

913. Patents on Hydrogenation. Comp. des Mines de Vicoigne, Noeux and Drocourt. E.P. 447,930, 28.5.36. Conversion of solid carbonaceous substances into liquid hydrocarbons at 420° C. and under a pressure of 100 kgms. or less per sq. cm., using as catalysts sodium or potassium compounds containing in the same molecule another metallic nodule such as aluminium, iron, tin, etc.

66.094.17 : 665.3

H. E. Potts. E.P. 448,334, 4.6.36. The product boiling between 200° and 400° C. from the destructive hydrogenation of coal is treated for the production of motor spirit, with butane at ordinary temperatures and the refined oil is destructively hydrogenated above 350° C., under 50–500 atm. pressure and in the presence of sulphides of Mo, W, Fe, Co or Ni as catalysts. W. S. E. C.

Gas.

547.213.2 : 66.095.2

914. Gasoline from Ethylene by Catalytic Polymerization. V. N. Ipatieff and B. B. Corson. *Ind. Eng. Chem.*, 1936, **28**, 860.—Gasoline has been obtained by the catalytic polymerization of ethylene using commercial "solid phosphoric" acid as catalyst, in a small pilot plant adapted for continuous flow. The investigation was carried out under conditions approximating commercial operation for gasoline production. Under the operating conditions used, polymerization was not the only reaction which occurred, as was evident from the nature of the product, which contained not only polymeric olefines, but also paraffins (aliphatic and cyclic) and aromatic hydrocarbons. Cyclization, dehydrogenation, hydrogenation, and isomerization also occurred. This type of polymerization the authors call "conjunct polymerization," and it is assumed that a master reaction—in this case, polymerization—furnishes the energy necessary for other reactions.

In the experiments carried out, the operating pressure was 520 lb./sq. in. gauge pressure, and the temperatures employed were 565° and 615° F. Each thousand cubic feet of ethylene yielded 4·7 gallons of 82 octane number gasoline (C.F.R. motor method), the total liquid yield being 7 to 8 gallons. Weight balances were obtained for two sets of conditions: (*a*) 520 lb./sq. in., 565° F. and 1400 seconds contact time; (*b*) 520 lb./sq. in., 615° F. and 200 seconds contact time. Under these conditions the following conversions were obtained: (*a*) recovered ethylene 13·7%, butene 0·7, *iso*butane 11·6, liquid polymer 73·7; (*b*) recovered ethylene 18·0%, butene 0·8, *iso*butane 6·4, liquid polymer 74·5. In each case the liquid polymer contained paraffins, *cyclo*paraffins, olefines, and aromatics. H. E. T.

661.715.24

915. Liquefied Petroleum Gases. M. J. Conway. *Oil & Gas J.*, 18.6.36, **35** (5), 57.—Sales of liquefied petroleum gas in the U.S.A. are estimated to have been 63 million

gal. in 1935, and a table shows the sales of gas in bottles, for industrial use and miscellaneous purposes, and for gas manufacture from 1922 to 1935. Propane is increasing in proportion to total sales, as it is not possible to include this product in present-day gasolines. Butane is being used to a greater extent as a component of motor fuel and for conversion into gasoline by special processes, so that its availability for other uses in large quantities is problematical. Improvements in methods of distribution, by use of tank cars and now tank trucks constructed of special steel, have given impetus to the sales of liquefied gas. On the Pacific coast trucks and trailer units now deliver gases to points up to 300 miles from the source of supply. The gases are particularly useful to consumers with a central point for distribution of vaporized gas, to small communities and to large estates. Industrially the chief applications are for cutting steel, brazing metals and alloys, welding aluminium, lead burning, direct-fired air heating for various purposes, metal-heating and heat-treating furnaces, internal-combustion engines for locomotives, etc. Application to industrial purposes shows the greatest increase over 1934 sales. Prices range from approx. 5 cents to 10 cents per gal. f.o.b. source of supply, and are not likely to fluctuate greatly, owing to the availability of the gases and the competitive position in relation to other fuels.

R. A. E.

622.324.5 665.511

916. Construction and Operation of Gasoline Plants, Parts I and II. R. L. Huntington. *Refiner*, 1936, **15**, 157–159, 178–182.—Part I discusses such influences as economic factors governing plant location, marketing factors, development of new markets, the raw material and the plant site. Apart from the natural gasoline market the chief markets for natural gas and its constituents are for manufacture of carbon black, bottled gas, aviation fuel and special solvents. It is stressed that the plant should be located near the field, and to ensure this in an undeveloped field it is necessary to carry out tests on the gas as well as exploration or reconnaissance work. The centre of the gas area having been located, the plant site must next be chosen having regard to drainage and, particularly, cooling of plant water as well as other items. In Part II the discussion is directed to the water supply, railway and pipe facilities, town-site locations, damage from plant drainage, type and size of plant units, oil absorption *vs.* direct stabilization, portable absorption units, gas-lift operation and oil substations. Diagrams of typical layouts are given as well as a graph on the economic balance between gas compression and oil circulation costs for a known set of conditions.

G. R. N.

66.074.37

917. Purifying Gases with Phenol Solution. A. Dobryanskii and others. *Goryuchie Slantzui*, 1935, **5** (1), 42–50.—A gas containing H_2S and CO_2, produced from shale, was purified by scrubbing with a phenolate obtained on treating a shale tar fraction (200–300° C.) with NaOH, being a mixture of sodium phenolates, oil and free caustic. Because the H_2S is absorbed three times as rapidly as the CO_2, a separation of these gases was effected by changing the speed of the gas and installing a second scrubber for the CO_2. Phenols were separated also, whilst H_2S was separated from the phenol by heating and washing. For. Petr. Techn.

665.511

918. Design and Operation of Fitts Gasoline Plant. J. C. Albright. *Refiner*, 1936, **15**, 173–177.—A detailed account of the construction of a modern gasoline absorption plant erected by the Carter Oil Co. at Fitts pool. Especial attention was given to drainage, obviation of soil corrosion of the pipes and removal of waste products. The plant will handle 34 million cu. ft. gas per day, and has yielded as much as 22,000 gal. gasoline. The latter is normally a 26/70 natural gasoline, and is sweetened by treating with concentrated chlorinated lime. G. R. N.

665.511

919. Economy in Natural Gasoline Plant Operation. W. L. Nelson. *Refiner*, 1936, **15**, 167–172.—In a mathematical discussion of gasoline plant operation costs an outline is given of a method of determining what is best practice in yields to secure

profits. It deals with costs of labour, steam, absorption oil, water circulation and other influencing factors. With the aid of tables and charts, it is shown that it is not always the best operating practice to attempt to secure 99% of the pentane-plus hydrocarbons, and under certain conditions a yield of 93·7% may be almost twice as profitable. G. R. N.

665.511 : 66.095.26

920. Polymerization of Gases to Produce Gasoline. C. R. Wagner. *Refiner*, 1936, **15**, 243–244.—The Phillips Petroleum Co. operate a polymer plant at Borger Texas, processing a high butane content natural gas under 1000–3000 lb. pressure and a temperature of 950–1100° F.; the 449° F. end-point gasoline has an octane no. of 79. The U.O.P. process is installed in several plants using phosphorus pentoxide as catalyst at a pressure around 200 lb. and temperature of the order of 400–500° F. The polymer gasoline is highly olefinic; the regular grade has an octane no. of 83, which the selective (di*iso*butylene) grade of octane no. 84 can be hydrogenated to give a 99 octane no. gasoline. The Pure Oil Co. process has been operated for 5 years, and will handle a variety of gases ranging between straight absorber exit gas and stabilizer reflux from which yields of 3·25 and 9 gal. per 1000 cu. ft. were respectively obtained without pyrolysis of the paraffins present; the polymer gasolines have octane numbers of 77–79. By polymerizing olefinic gases at 1175–1225° F. a gasoline of high specific gravity could be obtained. This gasoline, of octane no. 99, when freed of diolefines by acid treatment, was fractionated to give practically pure benzole, toluol, xylol and naphthalene. G. R. N.

665.521.1 : 66,095.26

921. "Coal Tar" Hydrocarbons Produced by Petroleum Polymerization. C. R. Wagner. *Nat. Petr. News*, 29.4.36, **28** (18), 22.—The article deals primarily with the catalytic polymerization process using phosphoric anhydride. This process applied to olefinic gases is capable of producing an overhead distillate which will yield 75–80% of 400° F. end-point gasoline of A.P.I. gravity 31–33. Such a gasoline, after washing to remove diolefins, consists almost entirely of benzene, toluene, xylene and naphthalene. H. G.

665.521.1 : 66.095.26

922. Conversion of Petroleum Gases into Hyrdocarbon Products. A. E. Dunstan and D. A. Howes. *J.I.P.T.*, 1936, **22**, 347–413.—A comprehensive account of the work carried out at the A.I.O.C. research station, Sunbury, on the many chemical and physical methods of converting petroleum gases into other useful products of hydrocarbon nature. G. R. N.

66.074.37 : 608.3

923. Patents on Gas. C. F. Rinsch. E.P. 447,813, 26.5.36.—Method and apparatus for detecting the presence of foreign solid, liquid and gaseous materials in gases.

66.095.26 : 608.3

A. Carpmael. E.P. 447,973, 25.5.36. Polymerization of olefines using as catalysts, liquid phosphoric acid and salts of heavy metals especially of copper or silver.

66.097.32 : 608.3

Grosselli Chem. Co. E.P. 448,125, 2.6.36. Production of silicic acid gels for use as catalyst carriers. Calcium carbonate in a finely-divided condition is thoroughly distributed through silicic acid hydrogel forming a wet mixture. This is dried and the carbonate extracted by means of an acid. W. S. E. C.

Motor Fuels.

662.753.12

924. ***Iso*Pentane has Major Rôle in Making 100 Octane Number Aviation Fuels.** F. B. Neptune, H. M. Trimble, R. C. Alden. *Nat. Petr. News*, 6.5.36, **28** (19), 25.—Since *iso*pentane is an abundantly occurring natural product, its utilization is an important problem. The present investigation shows that it can be added in considerable proportion to gasoline blends to produce fuels of high octane rating. Used in conjunction with *iso*-octane, it will achieve a great conservation of the latter product, while going far to rectify the loss of volatility which the use of *iso*-octane entails. H. G.

662.753.12

925. **Natural Trends.** T. W. Legataki. *Refiner*, 1936, **15**, 236–238.—The object of the paper is to bring up to date the volatility trends of motor fuel and show the small part played by natural gasoline in this changing picture. The data of Oberfell, Alden and Trimble on this problem for the period 1929–1934 are brought up to date for 4 major companies marketing in the Mid-Continent area, and shown in graphical and tabular form, the characteristics, average Reid vapour pressure, volatility number and estimated butane content yearly by months being given. Since 1932 there has been a steady rise of Reid vapour pressure from 8·5 to 9·5 lb., a more rapid rise of volatility number from about 30 to approaching 50, whilst butane content has remained steady around 5·7%. The significance of these changes is shortly discussed, and it is shown that at the present time approximately three-fourths of the light gasoline which supplies the motor fuel volatility was produced in the refinery, whilst one-fourth was supplied by natural gasoline. G. R. N.

662.753.12

926. **Methods of Expressing the Volatility of Gasolines.** W. W. Scheumann. *Refiner*, 1936, **15**, 239–241.—The A.S.T.M. distillation test and vapour-pressure test can be interpreted in engine performance so that gasolines can be made for any particular or general service. These tests are unsuitable for presentation to the general public, so the author considers there is a demand for a simple volatility index to summarize these tests. Several methods have been proposed; they relate chiefly to the middle portion of the distillation curve and, as such, to warming-up periods and acceleration. The indices of Brooks and Bruce, Oberell and Alden, and Hebl and Rendel are discussed, preference being given to the last, which is a warming-up index based on the 20% and 70% points of the distillation test. It is debatable whether it is necessary to use one or two points of the distillation curve, but for the sake of simplicity the use of the 50% point is regarded as preferable, and would be of the same degree of accuracy. Another important factor is the need of a method of temperature correction which should be developed so that desirable index values can be maintained in hot weather without producing a gasoline having excessive vapour-locking tendencies. Eight references. G. R. N.

662.753.12

927. **Characteristics of Aviation Fuels.** Y. Durier. *Mon. Petr. Roumain*, 1936, **37**, 753–755.—The author deals with the various physical properties of aviation fuels and discusses the influence of each property on efficient carburation. He points out that the problem is very complex, and that bench tests can give little indication of the behaviour of an engine under the varying conditions of flight. In his opinion the further development of aero engines will be chiefly along the lines of carburation research, and he therefore stresses the need for close co-operation between engine manufacturers and refiners. C. W. W.

662.753.12 : 66.067.1

928. **Clay Treatment of Motor Fuels.** M. R. Mandelbaum and P. F. Swanson. *Refiner*, 1936, **15**, 219–224.—An A.P.I. paper describing the development of the Gray process which, of the three clay-treating processes, viz. Gray, Osterstrom and Stratford, is the most widely used, world capacity being 140,000 bri. per day. Correlation of

available data is made difficult by differences in the oils treated, specifications and design limitations so that clay life may vary from 800 to 27,000 brl. per ton fuller's earth. The factors causing this divergence may be summarized: Paraffinic cracking stock increases ease of treating; gasoline from cracking distillates is more easily treated than gasoline ex residuum; the more severe the cracking conditions the more difficult it is to treat; sulphur content does not affect, or is not affected by, clay treatment; colour specification, sunlight exposure tests and induction period specifications vary widely, whilst control tests are sometimes applied to the clay-treated gasoline alone or in admixture with the other gasolines made. The life of the clay is also influenced by such design factors as brl. gasoline per ton per hr., temperature and pressure of treating, number and arrangement of clay beds, ratio of depth to diameter of clay beds, type of adsorbent, recirculation of gasoline, etc. A normal cracked product from a representative charging stock should be expected, in a Gray unit operating at 40–60 lb., to treat a minimum of 2000 brl. cracked gasoline per ton fuller's earth, giving a product to be marketed unblended, uninhibited and undyed. Data is then given of two high-pressure Gray units operating at 5 brl. and 1 brl. per ton per hour respectively. The higher throughput operates in connection with a 30,000 brl./day combination cracking unit processing East Texas crude, and has a clay life of 27,000 brl. per ton. The clay-treated gasoline is inhibited with b.a.p. inhibitor. The low throughput unit has a clay life of 4000 brl. per ton, and produces a gasoline very stable to colour and copper dish gum. Recent developments of the Gray process include the treatment of cracked gasoline from Kettleman Hills crude and polymer gasoline (clay life around 20,000 brl. per ton). G. R. N.

662.753.12 : 662.754

929. Gasoline and Alcohol–Gasoline Blends. L. T. Brown and L. M. Christensen. *J. Ind. Eng. Chem.*, 1936, **28**, 650.—The influence of engine speed, air–fuel ratio and throttle opening on the relative power output, specific fuel consumption and carbon monoxide content of the exhaust gases when comparing a 65–66 octane (C.F.R. Research method) gasoline with a blend consisting of 10% by volume of ethanol and 90% of the same gasoline is described.

Data are given in graphical form, and it is concluded that, while the alcohol-gasoline blend is inferior at high engine speeds, operation at low engine speeds and part throttle favours the blend. Carburettor setting is shown to be the same for the two fuels for satisfactory practical operation, and the findings agree with the statements of previous workers. F. E. A. T.

665.521.2

930. Stability of the Light Fraction of Cracked Gasoline. V. K. Shchitikov. *Neft.*, 1935, **6** (7), 15–16.—The opinion voiced by some authors in favour of distilling the lighter ends (boiling below 115° C.) of cracked gasoline and giving them only a caustic treatment, because of their stability, is contradicted by experiments which show a high gum formation in such fractions after storage in the dark. For. Petr. Techn.

665.521.23

931. New High Octane Blending Agent. H. E. Buc and E. E. Aldrin. *Oil & Gas J.*, 18.6.36, **35** (5), 41.—Principal developments in aircraft engines during the last decade are outlined. Curves for 1930 and 1935 Cyclone engines relating specific consumption to cylinder head temperature show the advantages to be obtained with the use of fuels of high octane number, permitting reduced consumption for cruising and take-off. A new high anti-knock material, *iso*propyl ether, is now available. Principal properties are: Density 20° C./4° C., 0·725; b.pt., 153/8° F.; freezing point, − 125° F.; gross calorific value, 16,900 B.Th.U. per lb.; Reid V.P., 5·3 lb. The solubility of the ether in water is low, and blends containing 40% of the ether pass the conventional water tolerance test for aviation spirit. Approximately equal portions of 40% blend and water shaken until equilibrium was established showed a contraction of 0·52% of the gasoline layer. The water content of this layer was 0·09%, so the total loss of ether by solution in water was 0·61% of the blend, or 1·5% of the ether present. The tendency of the 40% blend to separate water on cooling has also been examined, and it was found

that although the ether blends dissolve more water than aviation fuel, and a 40% benzole blend at 77° F., they also retain more water at temperatures as low as — 20° F. Ice separation tests carried out at — 20° F. on fuels saturated with water at 77° F. showed for aviation fuel 0·0005 ml., for 40% benzole blend 0·003 ml. and for 40% ether blend 0·005–0·006 ml. per 100 ml. of fuel. When 0·5% methanol was added to the ether blend, the separation occurred as liquid and not ice at — 10° F. The freezing point of this separated liquid was — 50° F. The tendency of the ether to take up water, therefore, does not appear to be an important handicap to its use in aviation fuel. Blends of the ether in aviation gasoline have low gum contents, and with addition of 1–2 mgm. of inhibitor to 100 ml. of fuel, the blends have a satisfactory resistance to oxidation. Storage tests at present extending for 2½ months tend to confirm the results of conventional oxidation tests. A considerable amount of data regarding octane numbers by various methods of test of blends of *iso*propyl ether with aviation gasoline of 74 octane number A.S.T.M., with and without addition of lead tetraethyl, are presented and compared with blends of similar composition but using technical *iso*-octane in place of the ether. By Army method of test a 100 octane fuel can be prepared by blending 40% ether, 60% aviation gasoline with 3 ml. T.E.L. per U.S. gal. The blending value of the ether is slightly superior to that of *iso*-octane in aviation gasoline. The same applies to any fixed amount of T.E.L. in the corresponding blend.

A recent survey of potential supplies of propylene, the raw material used in the preparation of the ether, indicates the possibility of producing 340 million gal. of *iso*propyl ether p.a. in the U.S.A., or sufficient for 850 million gal. of 100 octane fuel with addition of 3 ml. T.E.L. per gal. Tests run on high output multi-cylinder engines comparing performance of 100 octane number fuels prepared with the aid of (1) *iso*-octane and T.E.L. and (2) *iso*propyl ether and T.E.L., with that of 92 octane fuel prepared from aviation spirit and lead indicate: (1) the *iso*propyl ether blend has a min. specific consumption of 13% lower than the 92 octane blend, under cruising conditions, but 5–7% higher than the *iso*-octane blend; (2) the lower economy of the ether blend compared with the *iso*-octane blend can be overcome by going above 100 octane number. (3) The 100 octane blends of ether and *iso*-octane are equal in power output and consumption under high power conditions, such as during take-off. R. A. E.

665.521.23

932. Gasolines and Gasoline Fractions. C. O. Tongberg, D. Quiggle, E. M. Fry and M. R. Fenske. *Ind. Eng. Chem.*, 1936, **28**, 792.—The susceptibility of several gasolines and gasoline fractions to tetraethyl lead and aniline has been determined. The gasolines were fractionated in a column of seventy-five theoretical plates and a reflux ratio of forty to one. Fractions of high octane number and suspected high responsiveness to tetraethyl lead were blended. The octane numbers were obtained by a series 30 B. ethyl knock-testing engine, operating at 345° F. jacket temperature and at a motor speed of 900 r.p.m. The relationship between the method used and the C.F.R. engine operating under the motor method, is given. From the data obtained it is evident that octane number and lead susceptibility are not dependent alone on the boiling range of the fraction, since fractions of the same boiling range prepared from different gasolines have considerable variations in octane number and lead susceptibility. These variations may in part be due to the fact that different hydrocarbons and perhaps sulphur compounds are present in the various fractions, or blends, although they have the same boiling range. The observations on knock are in agreement with more complete chemical and physical studies which are being carried out on these fractions. The addition of aniline to gasolines containing tetraethyl lead has also been investigated. Addition of aniline up to 7% by vol. gives an almost linear increase in octane number for straight-run gasolines, whereas tetraethyl lead gives only a small increase when 2–3 c.c. are used. For cracked gasolines addition of aniline gives a greater increase in octane number for the first 2% than it does for the second 2%, but from 2 to 7% the increase is almost linear. The effect of addition of aniline to a gasoline containing tetraethyl lead indicated that the two compounds act independently of each other. H. E. T.

665.542

933. Revamped Gasoline Treating System. Anon. *Refiner*, 1936, **15**, 189–190.—The cost of chemicals in soda plus doctor washing a cracked gasoline before gum inhibition

was reduced from 6 cents to 2 cents per brl. at the Allen plant of the Sunray Oil Co. by using alloy cast iron outside mixing nozzles instead of the perforated spiders which were fixed in the soda and doctor washing columns. More efficient settling was also obtained by increasing the strength of the doctor from 16° Bé. to 30° Bé.

G. R. N.

665.521.4

934. Production of Hydrocarbon Oils from Industrial Gases, Part II. W. W. Middleton and J. Walker. *J.S.C.I.*, 1936, **55**, 121T–124T.—The time of contact between reactants and catalysts must be carefully controlled. Single- and multiple-stage workings are discussed, the effect of concentration of diluents and of contact-time have been studied. A curve comparing the production of synthetic oil from three gases containing increasing contents of diluents indicates that dilution of reacting gases increases the yield of oil. No difference is found in the type of oil produced from rich or diluted gas mixtures and, further, the ratio of carbon-monoxide to hydrogen in the reactant mixture is without effect on the distillation range of the product. The unsaturated constituents of the synthetic oils are mono-olefins, the presence of which has a beneficial effect on the octane number of the motor spirit fraction. The latter is remarkably free from gum-forming constituents and has good storage properties; it has also good susceptibility to tetraethyl lead.

W. A. W.

665.521.2 : 608.1

935. Patents on Motor Spirit. Carbo-Norit Union. E.P. 447,533, 20.5.36. Refining of motor spirit by submitting the spirit to the action of an alcoholic solution of ferric chloride at temperatures above the incipient b.pt. of the fuel and under pressure, either before or whilst distilling the spirit.

W. S. E. C.

Kerosine.

665.521.2 + 665.521.3 : 665.545

936. Colour Restoration of Gasoline and Kerosine. J. B. Rather and L. C. Beard, Jr. *Refiner*, 1936, **15**, 217–218.—The discoloration of gasoline and kerosine, initially water white, when held for some time in storage, has been an annoying and costly problem, *e.g.* in India in 1928 the price differential of the two kerosine grades was Rs. 1 per 10 gal., so that if the contents of a 80,000-brl. tanker reverted, the loss would be about $140,000. Initial studies were directed to oxidation inhibitors which would act as colour stabilizers. Among the compounds found suitable in as low concentrations as 1 lb./15,000 gal. were thiocarbonilide, hydroquinone, resorcinol, pyrocatechin, pyrogallol, phloroglucinol, 1 : 2 : 4-trihydroxybenzene, butyl pyrogallol, alkyl-substituted dihydroxy- and polyhydroxy-benzenes, ethanolamines, urea and thiourea. Some idea of the effectiveness of these inhibitors is shown by the following experiment. More than 100 cases of kerosine were shipped abroad and stored for 6 months under tropical conditions, then shipped back for examination. Half of the oil had been inhibited with 1 lb./10,000 gal. pyrogallol. The initial colour of the kerosine was 18–21 Saybolt, while after storage 82% of the inhibited oil had a colour of 12 + and 1% a colour below − 1, while only 14·3% of the unstabilized oil had a colour of 12 +, and more than 41·5% gave a colour of − 1 or lower. Some of the anti-oxidant compounds, especially the polyhydroxybenzenes, proved to be capable of restoring the oils to nearly the initial colour, which persisted with only slight loss for 6 months. The inhibitor was dissolved in ethyl or *iso*propyl alcohol, and the solution was added to the oil in the proportion of 1 gal. to from 2000 to 15,000 gal., depending on the age and condition of the oil. The inhibited kerosine should not be stored over water. If an oil has been raised to a colour of 14 + by an inhibitor, but is still unmarketable, then an oil-soluble blue-violet neutralizer can be added to finish off the treatment.

G. R. N.

665.521.3 : 66.094.56

937. Sulphonation of Cracked Kerosine. A. A. Voznesenskii. *Neft.*, 1935, **6** (2), 14–15.—The cracked kerosine, I.B.P. 220° C., 60% at 230° C. and 85% at 240° C.,

was treated four times in succession with oleum (20% free SO_3), yielding up to 40% of a sulphonic acid mixture suitable for splitting fats. Its effect on fats was 45% of a sulphonic acid prepared from vaseline oil. The hydrocarbon constituents gave a satisfactory illuminating oil. For. Petr. Techn.

665.521.3 : 66.094.3

938. Catalytic Air-Oxidation of Kerosine in the Vapour Phase. R. Klatt and H. Jellinek. *Refiner*, 1936, **15**, 183–186.—Experiments are described on the determination of the best oxidizing conditions for converting a naphthene base Russian kerosine into the maximum amount of water-soluble compounds. 5% vanadic catalyst (deposited on pumice) was most suitable at a reaction temperature of 440° C., about 7·5% of converted material being obtained. The ratio of water to kerosine vaporized was 3 : 1, whilst that of air to kerosine was 1870 vols. The reaction product consisted of a water-soluble yellowish-brown-coloured material, highly acidic and having a pungent odour. A heavy white precipitate was also formed at the oil–water interface, which was apparently solid fatty acids. It was not possible to characterize individual compounds in the reaction product, but in certain cuts the presence of formic acid, formaldehyde, acetic acid, acetaldehyde and acetone was demonstrated. G. R. N.

Lubricants and Lubrication.

621.891.23

939. "Oiliness Index" as a Criterion of Lubricating Oil Quality. F. W. Breth and L. Liberthson. *Oil & Gas J.*, 7.5.36, **34** (51), 42.—Great importance has been attached to individual properties of lubricating oils such as V.I., film strength, etc.

It is suggested that the most important single property of a lubricating oil is "oiliness." Indirect interpretation of "oiliness" in terms of friction is considered inadequate. The object of the investigations reported is to show that the conception of Parish and Cammen, that oiliness is synonymous with adhesion, is more illuminating. A number of samples of S.A.E.20 and S.A.E.40 oils have been tested in the Adherascope, and the amount of oil retained on the band has been measured. In each series a Penna long residuum was included, and assumed to have an oiliness index of 100, the oil having the lowest adhesion in each series being evaluated as nil. Oiliness indices of the other oils can then be calculated on this scale. The long residuum was taken as a basis for evaluation, as by this process the "proto oil" referred to by Breth and Kessler is retained in the lubricant. Certain additives which depress pour point and increase oiliness when added to Penna long residuum oils improve the oiliness index. Excessive dewaxing of the oil depreciates the oiliness index. Tricresyl phosphate, a material added to improve film strength, tends to reduce the oiliness index slightly. Naphthene base oils have the lowest indices of the types tested. Solvent extracted Penna oil has a value of 74, and dewaxed solvent extracted Californian oil 52, showing that solvent extraction processes, whilst increasing V.I. of oils, do not increase "oiliness," and subsequent compounding with an "oiliness" agent is necessary. Certain of these observations reflect known facts, so it is considered that the "oiliness index" is a useful tool in the selection of refining methods and compounding agents. R. A. E.

621.892.2 : 66.094.3

940. Oil Oxidation. R. W. Dornte and C. V. Ferguson. *Ind. Eng. Chem.*, 1936, **28**, 863.—The rate of oxygen absorption in a circulatory system is applied to the study of lubricating oils, the oxidation of which is unaffected by the non-volatile oxidation products. All the experimental results obtained may be represented by a simple empirical law, and the total oxygen absorbed is a linear function of the time at constant oxygen pressure and temperature. Further, the rate of oxidation varies according to an almost linear relation with the partial pressure of the oxygen. The main oxidation products are carbon dioxide and water; no peroxides were formed. In all probability no chain mechanism is involved in the oxidation reaction. The catalytic effect of various metals, notably tin, copper, iron and lead, has been studied, and the catalytic effect of these metals depends on the partial pressure of the oxygen

and on the ratio of metal to oil. In the case of copper the rate of oxidation increases rapidly with the copper–oil ratio, but for the other metals this ratio has only a small effect. The nett heat of activation for the catalysed reaction was determined for a fixed metal–oil ratio; further, these metals cause no great change in the nett activation heat, although the rate of oxidation varies considerably. The method used gives a good empirical evaluation of catalytic effects on lubricating-oil oxidation.
H. E. T.

621.892

941. Regeneration of Used Oils. Anon. *Olii Min.*, 1936, **16**, 14–15.—A brief description is given of methods of regenerating used lubricating oils, *e.g.* the oil is heated to 50–70° C., water and suspended solids are allowed to settle and the oil is decanted. The latter is treated with 3–5% sulphuric acid, the acid tar separated and the oil filtered through floridin earth and heated to 130–150° C. The volatile constituents are removed, using superheated steam. The advantages from the Italian point of view of the use of recovered oils are emphasized.
C. C.

665.543.061.5

942. Fundamentals of Solvent Refining. J. W. Poole. *Refiner*, 1936, **15**, 199–204.—An A.P.I. paper giving in as simple a manner as possible an exposition of certain basic principles, which must be recognized in the operation of commercial extraction processes.
G. R. N.

665.545.3

943. Propane De-Asphaltization and Dewaxing of Mid-Continent Residuum. A. P. Anderson, H. O. Forrest and L. van Horn. *Refiner*, 1936, **15** (6), 210–216; *Nat. Petr. News*, 20.5.36, **28** (21), 49.—An A.P.I. paper describing the design and operation of the propane plant at the Wood River refinery of the Shell Corporation. This plant represents the initial commercial application of de-asphaltization, and also includes the novel feature of continuous pressure filtration. The process consists of mixing long residuum with about 4 vol. propane, settling the asphalt and then removing about 2·5 vol. propane. The remaining solution is chilled by self-evaporation with addition of propane, cooled by exchange, to maintain concentration, and is then filtered to remove wax, and all products are depropanized. The plant has been operated at design capacity of 2450 brl. per day of dewaxed oil, since chiller-foaming has been overcome and the initial difficulty of pumping the wax cake solved by adding a small quantity of solvent to the cake in the wax conveyor. Filter operation is highly satisfactory utilizing a pressure differential of about 4 lb. maintained by propane vapour, and filter rates of 3–4 gal. dewaxed oil per sq. ft. are obtained. Pour test of dewaxed oil is consistently − 10° F., and subsequent solvent extraction and distillation give stocks having pour points of 0° F. or below and cloud points below + 20° F. Average yields are about 78% de-asphaltized and dewaxed oil (S.U. Viscosity 105/210° F.), 3·5% asphalt (A.S.T.M. softening point 170° F.) and 18·5% wax (m.pt. 137° F.) with the unwashed cake containing about 30% oil with reduction to 15–20% realizable with washing.
G. R. N.

665.545.3

944. Solvent Dewaxing Process. W. P. Gee, W. Kiersted and B. Y. McCarty. *Refiner*, 1936, **15**, 205–209; *Nat. Petr. News*, 13.5.36, **28** (20), 29.—An A.P.I. paper describing the developments of the acetone–benzole dewaxing process. The requirements of a dewaxing process are stated to be: (1) produce from waxy stocks the maximum yield of wax-free oil consistent with fluidity and having the desired pour point; (2) dewax any lubricating stock; (3) permit rapid change over from one stock to another; (4) be economical to operate; (5) be low initial cost; (6) be flexible in design; (7) be so advanced in fundamental theory as to obviate absolescence.

The acetone–benzole process has successfully dewaxed all types of stock from gas oil to heavy residue on a commercial scale (a table is given of the results on twelve different stocks). Developments of the process include rapid change-over of stocks, reduction of solvent loss from 0·2 to 0·5% of solvent turnover every 2–3 hours, re-

duction by 50% of operating cost, unitization of equipment, to allow for future expansion with minimum trouble, change-over from batch to continuous mixing, direct ammonia expansion chilling in place of double stage brine cooling, increased surface continuous drum type vacuum filters and rotating leaf-pressure filters, insulated filter shells to cut out the use of cold rooms and complete re-design of the original solvent recovery unit. A flow diagram of the process is given. G. R. N.

665.543.061.5 : 608.3

945. **Patents on Lubricating Oil.** Sharples Specialty Co. and L. D. Jones. E.P. 447,415, 18.5.36. Dewaxing of lubricating oil using a heavy solvent containing 75% by volume of ethylene dichloride and 25% by volume of benzene.

665.521.5 : 608.3

W. V. Gilbert. E.P. 447,687, 22.5.36. Anti-corrosive lubricant prepared by amalgamating 1 pt. by wt. of zinc chromate, 2 pts. of calcium chromate and 50 pts. of castor oil in the presence of superheated steam.

665.521.5 : 608.3

A. W. Nash, T. G. Hunter and W. R. Wiggins. E.P. 447,778, 26.5.36. Production of valuable viscous liquids with improved viscosity index by blending chlorinated hydrocarbons containing at least 10 carbon atoms, *e.g.* chlorinated coal products with metallic aluminium and hydrocarbons such as aromatic extracts from solvent extraction processes or aromatic liquids prepared by pyrolysis of gaseous or liquid hydrocarbons.

621.890 : 608.3

F. G. Baender. E.P. 448,009, 29.5.36. Reclaiming used lubricating oils by treatment with sulphuric acid, removing the sludge formed, neutralizing the remaining oil and mixing it with fuller's earth. The mixture is then distilled to remove moisture and light components are expelled by heating below cracking temperature.

W. S. E. C.

Paraffin Wax.

665.521.6

946. **Manufacture of Paraffin Wax from Petroleum.** R. H. Espach. *U.S. Bureau of Mines Bulletin* No. 388.—This bulletin is a comprehensive account of wax manufacture in U.S.A., and is based on data collected during 1929–30 from 30 refineries, which together accounted for more than 75% of the annual U.S. wax production at that time.

A preliminary discussion of properties and tests devotes considerable attention to colour, appearance and mechanical properties. It is stated that the appearance of paraffin wax is probably much influenced by the relative amounts of higher waxes, isoparaffins, or other hydrocarbons such as "soft wax" (Buchler and Graves), "ceresine" (Sachanen) and "asphaltic impurity" (Padgett, Hefley and Henriksen).

The tensile strength of wax is regarded as significant for wax-paper makers, but no general method of test is yet in use. The Perkins Tester, in which a standard briquet is pulled apart at a standard rate against the tension of a spring gauge, is described. The large effect of small oil contents (0 — 0·5% oil) on tensile strength is illustrated graphically. High tensile strength is associated with good stability with respect to colour and odour. A "press" method and a refractometric test are mentioned for the direct determination of oil content.

The methods and equipment used by various U.S. wax refiners are described with much practical detail under the following headings :—

(1) *Wax Distillate.*—Those methods of crude distillation which allow of sharp fractionation yield wax distillate which is most suited to pressing. The quality of the distillate is controlled by determinations of gravity, still temperatures, viscosity, distillation range, and by micrographical examination. In some cases, particularly when the wax distillate is of poor quality, a chemical treatment is given prior to chilling.

(2) *Chilling.*—The construction and operation of chillers of the double-pipe and Gray types are discussed in detail. When no other cold plant is present, it is better to insulate the double pipes themselves rather than the room in which they are housed. Reference is made to the occasional use of ribbon scrapers and refrigeration by direct ammonia expansion.

(3) *Filter Pressing.*—In a discussion of the relative merits of loose-ring and riveted-ring filter plates, it is stated that the latter seem to be in more general use because they minimize cost of blanket maintenance. The design of the perforated plates is an important factor affecting the efficiency of a wax press. The pressing technique of numerous refiners is described; it is usual to adopt the lowest operating pressure at which the volume throughput can be maintained. Reference is made to the use of hot water for removing wax cakes and to the filtration of wax from solvent–oil–wax mixtures.

The properties of slack wax are dealt with, chiefly as regards "sweatability."

(4) *Sweating.*—(*a*) *Pan sweating.* Some American refiners prefer perforated plates to wire screens in pan sweaters. The pipe coils in each pan are arranged to secure uniform temperature in all parts of the wax cake. The slack wax is generally chilled to 80–85° F., in some cases with the aid of water in the pipe coils, and occasionally by forced circulation of air.

When the slack is being sweated to refined grades, steps are taken to ensure uniform oven temperatures; this is best effected by circulating the air by means of fans, a maximum variation of only 2° F. over the whole oven having been observed in one such case. Sweater thermometers of the recording type are recommended.

(*b*) *Tank sweating.* Although less generally used, tank sweaters are not regarded as less efficient than the pan type. They are easier and cheaper to operate, but are slower to cool, and in some cases are less easily controlled. Mention is made of the Alanmor sweating stove and of the measures taken to minimize water corrosion therein. Sweated scale containing 2% or less oil may be marketed as such (122–124° F. and 124–126° F.). Scale containing less than 1% oil is sometimes sold as "semi-refined" wax. Chemical treatment (H_2SO_4) is applied to (*a*) crude scale, (*b*) slack wax, or (*c*) wax distillate, but rarely to the finished wax.

All wax except yellow scale is filtered (usually through fuller's earth) to improve the colour.

Pan-moulding for fully refined waxes has been almost completely superseded by press-moulding, but, where still used, it is best effected by cooling the pans in water and by pouring the wax at correctly chosen temperatures.

The bulletin concludes with sections devoted to wax-plant arrangement and personnel. P. G. H.

665.521.6 : 66.094.406

947. Fluorinated Paraffin Wax. Anon. *Chem. Trade J.*, 10.4.36, **98**, 306.—E.P 443,340 of 1935, granted to the British Thomson-Houston Co., Ltd., covers the use of fluorinated paraffin wax as a dielectric material. It is prepared by treating chlorinated paraffin wax with SbF_3 in a suitable solvent, *e.g.* C_6H_6, in the presence of a catalyst, *e.g.* $SbCl_5$ (5–10% on the SbF_3), at the boiling point of the solvent with constant stirring. The fluorinated paraffin wax is liquid at ordinary temperatures, and can be separated from unreacted solids by filtration, the solvent being removed by distillation. The residual fluorinated wax is refined with adsorbent earth. It is chemically stable and non-volatile at ordinary temperatures. A wax containing 25% by weight of F has the following properties: Pour point — 14° C.; viscosity at 100° C. 50 secs.; Sp. Gr. at 60/60° F. 0·99. A fluorinated paraffin wax containing 45% by weight of F has pour point — 3° C., viscosity at 100° C. 94 secs.; and Sp. Gr. at 60/60° F. 1·14. A similar wax in which the proportion of combined F is at least approximately equal to the proportion of combined H_2 is non-inflammable, and has a dielectric constant of 5–7 (compared with about 2·2 for mineral oil).

Paper for electric-cable insulation impregnated with fluorinated paraffin wax is rendered non-inflammable and resistant to moisture, highly resistant to electrical breakdown and has a high stability towards ageing. The viscosity of the wax when at the operating temperatures of transformers is high, a lower viscosity being obtained by mixing with an equal proportion of $C_6H_3Cl_3$ or C_2Cl_4. C. L. G.

Fuel Oil.

622.758

948. Colloidal Fuel. D. Brownlie. *Ind. Eng. Chem.*, 1936, **28**, 839.—A short review of the various processes for the manufacture of colloidal fuels. H. E. T.

662.753.3

949. Home-Produced Diesel Fuels. J. L. Strevens. *Gas and Oil Power*, 1936, **31**, 127.—S.I.T. values of a number of blends of coal-tar products, such as naphthalene, light phenols and tar acids, diesel fractions, topped distillates, with petroleum oils are reported. The apparatus used was the modified Moore oxygen type. In general, for good performance in diesel engines not more than 25% of high-temperature tar oils can be blended with petroleum oils, but larger percentages of low-temperature tar oils may be employed. Phenols and tar acids increase the S.I.T. of blends, but do not appear to affect engine performance. They may, however, give rise to corrosion of metal parts with which the fuel comes into contact. Addition of naphthalene is beneficial in respect of increasing calorific value per gal., and in small proportions does not appreciably affect the S.I.T. of the blend. The amount which can be used is limited by the necessity of maintaining the naphthalene in solution at the lowest prevailing atmospheric temperature. Factors affecting combustion of coal in coal-dust engines are discussed. In this country the use of a colloidal fuel in existing types of engine appears more promising. R. A. E.

662.753.3

950. Industrial Fuel Oils. H. V. Hume. *Refiner*, 1936, **15**, 142–146.—A general discussion of the use of fuel oil in various industries, the significance of the tests used to characterize them and the types of burners employed in their combustion. Tables are given showing the distribution of fuel oil among the industries and the detailed requirements for 6 grades of fuel oil. G. R. N.

662.753.3

951. Application of Heavier Fuel Oils. H. Kåhr. *Petr. Zeit.*, 24.6.36, **32**, 26.—The use of heavier fuel oils in burners is considered and specifications for such oils used in Sweden cited. Details of their application are given *e.g.* method of preheating the oil to 30–35° C. in the storage reservoir before entering the burner and further heating to 50–65° C. before atomizing. W. S. E. C.

662.758

952. Home-Produced Diesel Fuels. J. L. Strevens. *Gas and Oil Power*, 1936, **31**, 153.—Properties required of "colloidal" fuels, and of the coal used in their preparation, for diesel purposes are discussed. From viscosity consideration it is unlikely that more than 30% of coal could be included in such fuels. It is not difficult to prepare 30% suspensions of certain coals in light petroleum distillates, provided the coal is suitably ground and the oil is given a moderate "gel" structure with a suitable stabilizer. Fuels of this type have been prepared using a rubber stabilizer and fuel oil blended with washed low-temperature creosote as oil medium. These blends gave satisfactory engine performance, but after a short period caused packing of coal particles in the fine parts of the pumping and injection systems. The particle size averaged 10 microns, but some larger particles were present, and these were doubtless responsible for the packing effect. Average particle size of 3 microns with a max. of 10 is suggested as desirable. Mixtures with high-volatility bituminous coals started more easily than those with semi-anthracite, but on warming up both ran equally satisfactorily and with a clean exhaust. Results of tests carried out on 50/50 coal–oil mixtures in a Rupa coal-dust engine are reported.

It is unlikely that such fuels will find application in high-speed diesel engines, but they might be used in slow-speed engines if liner wear is not unduly high.

Effects of the type of coal used on the S.I.T. of the coal–oil blends are illustrated and discussed. R. A. E.

665.521.4 : 66.092

953. Conversion of Fuel Oil into More Profitable Products. A. L. Foster. *Nat. Petr. News*, 6.5.36, **28** (19), 33.—The utilization of surplus heavy fuel oil from cracking units is accomplished by further cracking to coke. The unit comprises a fractionating column, evaporator, and four Knowles coking ovens, each of which is equipped with stirrers to keep coke fines in suspension. The residuum from the cracking plants is flashed in a heater and the fractionating column and passes, at a temperature of 870° F. and 100 lb. pressure, to the evaporator, where the Sp. Gr. of the residuum is 1–2° A.P.I. This residuum is passed to the coking ovens. These are $10' \times 30'$, and entirely sheathed in an airtight steel shell. The floors are of carborundum tiles, and are closed in front by steel doors, which may be raised vertically and are sealed with luting cement. When " on stream " the internal temperature of the ovens is 1400–1600° F., while channels below the floor are maintained at 2400° F. The heavy tar is fed in until a coke bed 10 inches thick is obtained. The tar feed is then stopped, and the coke bed is " dried " for a further 3 hours. The steel doors are raised and the coke bed is pushed out by a mechanical ram into steel cars for quenching and grading. The yields of products are as follows: overhead distillate 7·53%, recovery light gasoline 3·5%, dry gas 11·0%, furnace oil 55·65% and 23·9% coke. The coke, which contains approximately 1% volatile matter, is satisfactory as a domestic or industrial fuel, but is being used at present exclusively for the manufacture of electrodes.

H. G.

Asphalt and Bitumen.

665.454.42

954. Asphalt Cutting. G. MacLean. *Refiner*, 1936, **15**, 187–188.—The preparation of a cutback involves storage of the ingredients and blending and storing of the finished grades, which in turn requires such operations as gauging, pumping, blending and testing. It is advocated that the properties of each ingredient should be thoroughly known, so that gauging and uniform sampling can be efficiently carried out. The excessive time needed for mixing of the cutback by means of air blowing or by pump re-circulation, and the uncertainty that the cutback is up to specification, can be considerably reduced by use of a mechanical mixer of the type equipped with three centrifugal turbine impellers on the same vertical shaft. This outfit will pump as much as 90,000 gal. per minute, and will reduce the mixing time to well below 1 hour. The cutback oil is run in first, and the asphalt is then run in over the lower impeller. Owing to the possible variations in the properties of the ingredients, it is suggested that blending should be performed on the batch system.

G. R. N.

665.521.8 : 539.501

955. Rheological Properties of Asphaltic Bitumens. J. F. Pfeiffer and P. M. van Doormaal. *J.I.P.T.*, 1936, **22**, 414–440.—Some of the results of the extensive researches at the Amsterdam research station of the N.V. de Bataaf. Petr. Mij. on the constitution and rheological behaviour of asphaltic bitumens are given and their significance is discussed.

G. R. N.

665.521.8 : 539.533

956. Penetration–Temperature Relationships of Asphalts. I. Bencowitz and E. S. Boe. *Ind. Eng. Chem. Anal.*, 1936, **8**, 157–162.—An equation was found which expressed concisely the variation of the penetration of various asphalts. This equation, of the form $p = A + BC^t$ represented the experimental data for 13 asphalts of different sources and methods of manufacture, within experimental error. The equation could be readily solved by measuring penetrations at three temperatures such that $t_2 - 2t_3 + t_1 = 0$. The differential dp/dt represented the true susceptibility, but to conform to usage of similar characteristics of matter the susceptibility coefficient was taken as $1/p \times dp/dt$, which can be advantageously used for classification of all asphalts, providing the above form of equation holds. Since the coefficient was not a constant, it is suggested that an approximately constant factor to represent susceptibility can be obtained by taking the definite integral of dp/dt between the limits of the desired temperature. This factor represented the true order of the susceptibilities of the

asphalts studied. It was further shown that the ratio of penetration obtained with different weights at different temperatures was practically constant. G. R. N.

665.521.8 : 608.3

957. **Survey of Patents Relating to Bitumen During 1935.** Van der Werth. *Asphalt u. Teer*, 1936, **36**, 383–384.—Brief notes are given of a number of United States, British, German and French patents dealing with bitumen, bitumen compounds and bituminous emulsions, including some references to emulsifiers and stabilizers. C. C.

665.521.8 : 620.178.267

958. **Bituminous Plastics.** R. N. Traxler. *Ind. Eng. Chem. Anal.*, 1936, **8**, 185–188.—The determination of the flow properties of bitumen and bituminous mixtures is discussed, and it is indicated that these cannot be satisfactorily evaluated by any single method so far examined. It is considered that because of the number of variables encountered and the varying degrees in which each property may appear, absolute values will be difficult or impossible to attain. The flow of slate-bitumen mixtures was measured in a parallel-plate plastometer, whilst preliminary data on the flow of paving mixtures were obtained in a Baldwin Southwark compression testing machine. Viscous bitumens were tested by the alternating stress method, whilst the ageing effect was examined with the aid of a number of falling co-axial cylinder viscometers. Increase of viscosity through hardening with time was not so rapid with steam and vacuum refined asphalts as with the air-blown grades. The several methods devised to determine the plasticity of roofing and flooring asphalts are outlined. Twenty-one references. G. R. N.

665.521.8 : 620.193.12

959. **Bitumen and Zinc.** H. Walther. *Vedag Year Book*, 1936, 136–143; *Asphalt u. Teer*, 1936, **36**, 419–423.—This paper describes experiments which were made to examine the behaviour of coatings of bitumens, from different sources, on zinc plates which were exposed to the atmosphere. Three test-plates were prepared with each of the materials, the coatings being applied hot in two cases and in cold solution in the third. Uncoated strips were left at the top and bottom of the plates, the top strip serving as an indication of possible corrosion resulting from atmospheric causes, and the bottom strip to show the effect of the previous passage of rain-water over the coatings. The plates were exposed in an inclined position from July to Sept. 1935, and at the end of this period marked changes were apparent in the appearance of the coatings and the uncoated strips at the bottom of the plates. German, Polish and Russian bitumens showed light-brown weathered layers, two Mexican blown bitumens were also affected, but to a smaller extent than the preceding bitumens, whilst two Mexican high-vacuum bitumens were dull, and the harder of these bitumens had fine cracks on the surface, but chalking was slight. Coal-tar pitch showed no signs of ageing in the case of the hot coatings, whilst the cold coating was dull and wrinkled; this is attributable to the skin-forming action of the solution. Photographs showing the corrosion of the plates are given. These were taken with a magnification of × 20 and × 100 on the plates after exposure before and after removal of the coatings. The German, Polish, Russian and the two Mexican blown bitumens are said to have produced the same degree of corrosion of the plates, whilst the plates with Mexican high vacuum bitumens and coal-tar pitch were practically free from attack. No relationship was found between the sulphur contents of the bituminous materials and the effect on the coatings and the zinc. It is suggested that acidic corrosive materials are formed by the action of oxygen and moisture on certain bitumens; this is said to be confirmed by experiments in which various bituminous materials were placed in moist air or oxygen in Uviol tubes. A. O.

665.521.8 : 620.193.12

960. **Damage of Zinc Gulleys and Plates by Bituminous Roofing Felt.** E. Deiss. *Vedag Year Book*, 1936, 123–135.—Details are given of an investigation of cases of corrosion of zinc rain-water gulleys and edging plates on buildings having roofs covered with

bituminous roofing felt. It is stated that the damage was in general most extensive on parts of the buildings receiving the greatest amount of sunshine. In all cases the weathered surface of the bituminous roofing felt gave an acid reaction to moist litmus. The usual causes of zinc corrosion, *i.e.* action of injurious constituents of the atmosphere or flue gases, mechanical action of dropping liquids, poor-quality zinc are said not to have been effective in the cases investigated, but that the evidence pointed to the combined action of light, air and moisture as being responsible for the formation of water-soluble acidic materials, from the bitumen, which have a corrosive action on zinc. A. O.

665.521.8 : 620.193.6

961. Action of Light upon Bitumen Coatings. H. Walther. *Vedag Year Book*, 1936, 147–156.—This paper gives details of experiments made to compare the behaviour of different kinds of bitumen under the action of light. The materials examined were Mexican blown and high vacuum bitumens and coal-tar pitch of 60–63° C. (K. & S.) softening point; these were melted on to glass slides in layers 1 mm. thick, and the slides then placed in Uviol glass tubes, four tubes being prepared with each material as follows: (1) tube evacuated, (2) filled with pure dry oxygen, (3) and (4) filled with oxygen and air respectively, which was saturated with moisture by the addition of 2 c.c. of distilled water to the tubes. The tubes were then exposed for 420 hours, after which the following observations were made. The appearance of the coatings *in vacuo* was unchanged, but the coal-tar pitch and blown bitumen showed clear drops of oil on the tubes. In dry oxygen the materials had become dull and the bitumens showed numerous wrinkles, whilst the coal-tar pitch was least affected. In moist oxygen the blown bitumen had become friable, the high vacuum bitumen adhered better than the former, whilst the coal-tar pitch, although better than the bitumens, did not adhere well, and showed numerous fine cracks near a large vein. In moist air the behaviour was similar to that in moist oxygen, the blown bitumen being friable, the high vacuum bitumen being less affected than the blown bitumen and the coal-tar pitch the least affected. The change in weight of the coatings, acidity and decrease in solubility in benzole was found to be in the same order as the change in appearance of the coatings; the sulphur content was, however, the same as before exposure. Results are tabulated. A. O.

668.731 : 532.13

962. Viscosity of Road Tars. Part II. J. G. Mitchell and A. R. Lee. *J.S.C.I.*, 1936, **55**, 167T (cf. Abstr. No. 450, 1936).—By rewriting the empirical equation $d\eta/dT = -n\alpha/T^{n+1}$ in the form $d\eta/dT = -n\eta/T$, it is shown that the true susceptibility of a tar at any temperature (° F) is simply related to the log. temperature coefficient. Similarly, the formula $d\eta/\eta = -ndT/T$ gives an approximate relation between the percentage change in viscosity and the percentage change in temperature. C. C.

Special Products.

621.892.6

963. Water Soluble Oils. G. A. Rubtsov. *Neft.*, 1935, **6** (6), 16–17.—Stable emulsions for use as cutting oils were prepared as follows: (1) 20% naphthenic acids, 70% machine oil, 6% 34° Bé. caustic soda and 4% glycerine, (2) 20% naphthenic acids, 18% 45° Bé. caustic potash 12% water and 50% machine oil and (3) 20% naphthenic acids, 10% 34° Bé. caustic soda, 40% machine oil and 30% water. For. Petr. Techn.

66.062.21

964. Preparation of Solvent Naphthas from East Texas Heavy Naphtha. G. M. Woods. *Petr. Eng.*, June 1936, **7** (9), 107.—Data are given on the properties of solvents produced in the laboratory from the SO_2 extract of East Texas heavy naphtha, as compared with hydrogenated solvent naphthas. The base material was the 12% to 35% cut from East Texas crude (boiling range 188–489° F.), which was treated with 150% liquid SO_2 at − 20° F. The extract was washed with NaOH and water and redistilled to give

:uts corresponding to the hydrogenated naphthas. These had the following properties :—

	Hydrogenated Solvent Naphthas.				*Naphthas from SO_2 Extract.*			
Gravity A.P.I. .	50·6	34·0	26·2	19·6	38·6	34·1	29·6	19·7
Colour Saybolt .	25	23	23	0	28	25	24	21
Aniline Pt. ° F. .	52	−1	−10	−33	−20	−15	8	12
Dimethyl sulphate Value % .	24·0	62·0	87·0	100·0	86	95	98	100
Kauri Butanol Value . .	55·2	75·6	77·3	87·5	70	73	75	86
I.B.Pt. ° F. .	168	270	352	410	193	277	360	411
F.B.Pt. ° F. .	322	397	438	489	321	390	432	479

The total yield of solvents from the East Texas crude was 3·5%, these being as good as, or better than, the hydrogenated naphthas in solvent properties. The value of these solvents as lacquer diluents is high enough to make their production an economic possibility. Investigations of other solvent extraction methods and of the use of cracked naphtha as base material are being carried out. C. L. G.

661.471 : 553.7

965. Separating Iodine from Bore-Hole Waters. B. M. Suslov. *For. Petr. Techn.*, 1936, 4 (3), 118–119.—The presence of naphthenic acids in bore-hole waters renders the separation of iodine more difficult. The following methods were used : (1) The iodine was precipitated by addition of acid ; absorbed by activated carbon then removed as NaI by heating with sodium sulphite ; (2) activated carbon was replaced by starch from which the iodine was separated by treatment with sodium sulphate ; (3) the acidulated water is extracted with kerosine from which the iodine is separated by treatment with sodium sulphate ; (4) the water is mixed with kerosine, then treated with calcium hypochlorite from which iodine was separated as in (3). Iodine was obtained from the NaI produced by the above four methods by treatment with $KClO_3$ or NaClO. G. R. N.

661.764.4

966. Carbon Black. Anon. *Chem. Trade J.*, 17.4.36, **98**, 323.—In the U.S.A. in 1935, 390 million lb. of carbon black were produced, of which 139 million lb. were exported. 350 million lb. were made by the channel process from natural gas, mostly in the Panhandle district of N. Texas. With the exception of small quantities made in Russia, Japan and Rumania, the U.S.A. accounts for most of the world production.

The factors influencing the choice of the natural gas are given as :—(1) Nitrogen content, (2) sulphur content, (3) natural gasoline content, (4) gas pressure, (5) proximity of gas wells to carbon-black plant, and (6) industrial and domestic demand for the gas.

Oklahoma natural gas containing 0·31% N_2 yields 1·32 lb. of black per m.cu.ft. by the channel process, whereas Nocona, Texas, gas containing 41·27% of N_2 yields only 0·068 lb. of black.

Gas containing $> 1\frac{1}{2}$ grains H_2S or > 30 grains total S per 100 cu.ft. is regarded as sour, and is dangerous because of its corrosive action on the burner pipes.

Natural gasoline affects the recovery quality of the black, but is more profitable to extract than to burn for black production.

The applications of carbon black include : (*a*) rubber industry (182 million lb. in 1935), (*b*) printing ink (17·5 million lb.), and (*c*) paint lacquer and enamel manufacture (5·5 million lb.).

Three types of black are produced, based on the degree of adsorption of the organic accelerator, viz. slow, medium and fast curing. For rubber manufacture, mixing quality, particle size and freedom from grit are important. For printing-ink manufacture, the carbon black must be uncompressed, of good colour, easy to grind, have a ready oil absorption, a good top and undertone. For paint lacquer and enamel manufacture, a low bulk, jet-black colour, ease of grinding, low oil absorption and good suspension are required. C. L. G.

661.834.75

967. Industrial Applications of Metallic Soaps. H. C. Bryson. *Chem. Trade J.*, 29.5.36, **98**, 445.—Heavy metal soaps possessing good solubility in oil include the resinates, linoleates, stearates and naphthenates. The alkyl derivatives of benzyl benzoates and other aromatic acids are also being considered in the U.S.A. Fused soaps are less valuable than the precipitated soaps, as their metal contents are low, free acidity is high and batches vary. The usual method of manufacture is neutralization of the acid with Aq.NaOH, followed by the addition of an aq. sol. of the salt of the required metal. The precipitated soap is washed with water and dried by fusion, vacuum or air, or in some cases is purified by solvent extraction.

The applications of these products which are of interest to the petroleum industry include :—

Tin linoleate as anti-oxidant or resin inhibitor for petroleum products (tin naphthenate is not satisfactory).

Incorporation of tin soaps (either with or without chromium soaps) in the manufacture of lubricating oils to prevent piston wear and zinc oleate into greases.

Use of barium linoleate soap in floor or boot polishes, promoting solvent retention.

Incorporation of aluminium oleates and stearates into solutions of wax in petroleum products for waterproofing canvas, bricks, etc. Use of aluminium stearate as a lubricating oil thickener and for obtaining flow in flat paints.

Use of zinc, copper and mercury soaps in anti-fouling compositions.

Sodium naphthenate is water-soluble, and hydrolyses to only a small extent. It possesses excellent emulsifying and foam-producing properties, and has a high gelation capacity. A concentrated solution remains jellified at 0° C. It is also a good disinfectant. It is used in the manufacture of carpet soaps, dry cleaning soaps, painters' dry size, liquid and waterless soaps, and as a gear lubricant.

Lead naphthenate is an efficient waterproofing and rot-proofing agent for canvas, and is also used for grease manufacture.

It is stated that zinc naphthenate confers thixotropic properties on paint, but it is also claimed to assist dispersion, thus saving time on paint grinding. The New York Paint and Varnish Club found it the best wetting agent for pigments ground into paints of different types. Cobalt–zinc naphthenate mixtures, preferably containing small quantities of certain rare earths, accelerate the drying of alkyd resins. Zinc naphthenate also possesses fungicidal and antiseptic properties, and is an excellent blending agent for assisting miscibility.

Copper naphthenate has some drying properties, but is used mainly as an insecticide, fungicide and preservative. A 20% solution in naphtha is a particularly good timber-proofing agent, and has the advantage over creosote that it can be painted over. It is used as a parasite spray in chicken houses and in anti-fouling compositions.

Aluminium naphthenate is a rubber-like compound which can be used to thicken petroleum oils. It is soluble in drying oils and has some drying action, but has little flatting effect. It has non-penetrating properties and is of value in undercoats. It confers a gel-like structure on paints while in the can, without interfering with their flow, and prevents the settling of pigments like chrome green. Aluminium naphthenate in paints is anti-corrosive and water-resisting, and is used for the waterproofing of fabrics and paper, and produces very stable emulsions. C. L. G.

665.542.24

968. Acid Sludge. L. K. Adamyan and S. M. Avanesova. *For. Petr. Techn.*, 1936, **4** (3), 103.—Acid sludge from treating pressure distillate was diluted with 5 vols. water, heated and steam distilled at 180° C.; 23·37% brownish oil of cracked odour and Sp. Gr. 0·829 was obtained. Distillation analysis gave 7·4% below 100° C. (0·7404), 20% at 100–150° C. (0·7806), 31·3% at 150–200° C. (0·8191) and a 40·2% residue. G. R. N.

665.542.24

969. Improvement of Alkali Sludge. B. M. Erlikh. *Neft.*, 1935, **6** (5), 22.—Grozny crude oil receives before or during distillation an alkali treatment for the neutralization of petroleum and inorganic acids. The alkali sludge is high in unsaponifiables, and cannot be used as soap substitute. This difficulty was overcome by adding to the

sludge up to 30% of kerosine alkali sludge agitating the mixture at 8–12° C. with air during 1–2 hours, followed by a 3–4 hours settling period. The obtained layers were sharply divided, and the asphaltene content of the soap layer was lowered, while the required concentration of saponifiables and the minimum for unsaponifiables were attained without difficulty. For. Petr. Techn.

665.547.7

970. **Sulphonated Oils.** Anon. *Chem. Trade J.*, 1936, **98**, 361.—Methods of analysis recommended by the Sub-Committee on Grading and Analysis of Sulphonated Oils of the American Association of Textile Chemists and Colorists have been adopted by the American Sulphonated Oil Manufacturers Association. Tests standardized are: (*a*) moisture; (*b*) inorganic salts; (*c*) total alkalinity; (*d*) organically combined sulphuric anhydride, (1) titration method, (2) extraction-titration method; (*e*) total fatty matter; (*f*) total sulphated fatty matter; (*g*) total active ingredients; (*h*) unsaponifiable; (*i*) free fatty acids. Work on standardizing other tests, including determinations of neutral fat, *p*H value, ammonia, is now in progress.

The main features of the tests referred to under (*c*) and (*d*) (1) and (2) are reproduced. R. A. E.

665.547.83

971. **New Use for Naphthenic Acids.** L. Adamyan. *Neft.*, 1935, **6** (13), 16–17.—After reviewing a great variety of naphthenic acids, their soap and other derivatives, the preparation of "naphthiol" is described. The latter is prepared from a saturated solution of copper sulphate, which is poured into a 25% NH_4OH solution, naphthenic acids being then added. The obtained product has a dark-bluish colour and a Bé. gravity of 12–15°. It is used as a preservative for fabrics, etc., forming a solid colloid in the fabric after the evaporation of ammonia. It is claimed that fabrics impregnated with this mixture can stand a water immersion for 5–6 months, whilst those impregnated with tar lose this capacity in 1½–2 months. For. Petr. Techn.

665.547.83

972. **Naphthenic Acid Industry.** V. L. Shipp. *Oil & Gas J.*, 19.3.36, **34** (44), 56.—The increasing demand for naphthenate driers and the development of lead and aluminium base greases have directed attention to the possibility of the production of naphthenic acids from American crudes.

A short bibliography of the literature on naphthenic acids is given, with tables of the yields of acids from Baku and various American crude oils and distillates, and the properties of Baku and Californian acids, together with some notes on the applications of the various salts of naphthenic acids.

The results of corrosion tests on various metals in gas-oil naphthenic acids after 3 months immersion are given in terms of loss in grams per K.grm.: lead 6·10, zinc 4·68, copper 0·56, tin 0·18, iron 0·08, aluminium 0·00, antimony 0·11. At high temperatures corrosion is much greater, but stainless steel and cast iron offer good resistance. The lower acids are more active than the higher members.

The possible uses for free naphthenic acids include the reclamation of rubber and the breaking of crude oil emulsions.

Sodium naphthenate is used as a cheap soap filler and a scouring agent in the textile industry, possessing excellent lathering emulsifying and mild detergent properties. It also possesses disinfectant and limited germicidal action.

Calcium naphthenate is used in the manufacture of cheap substitutes for boiled linseed oil and in cheap greases. Copper naphthenate is used in anti-fouling compositions and wood preservatives.

Aluminium and lead naphthenates have been used for the manufacture of special greases, the former being also used for bodying mineral and vegetable oils where an increased ash content is not an objection.

Lead, manganese and cobalt naphthenates are excellent paint driers, and have excellent metal-carrying capacities, giving good stability to the paint.

The acids are derived from the caustic wash of naphtha and kerosine distillates, but are frequently difficult to remove, owing to the formation of emulsions and the presence of tarry material. The former difficulty may be eliminated by the use of

low concentrations of NaOH and mild agitation, or in more difficult cases by the addition of alcohol and by the use of higher pressures. The crude sodium naphthenate is prepared by partial evaporation of the water and subsequent salting out with NaCl (free from $MgCl_2$) or by direct evaporation to marketable water content (20–40%). A mixture of sodium naphthenate and naphthenic acid is frequently marketed for convenience in handling owing to its being a viscous liquid, whereas the sodium soap is a paste. From this mixture either product can be obtained.

The alkaline-earth and heavy metal naphthenate are prepared by double decomposition of sodium naphthenate with solutions of the respective metals or by fusing free naphthenic acids with oxides, free carbonates and hydroxides (applied commercially to lead and calcium naphthenates only). C. L. G.

665.581.4

973. The "Spectacular" Hydrocarbons. S. Born. *Oil & Gas J.*, 21.5.36, **35** (1), 124.—An historical survey of products manufactured synthetically from natural gasoline and natural gas is presented. Among the products mentioned are amyl acetate, ethylene glycol, artificial rubber, alcohols, esters, aldehydes and synthetic resins. Future possibilities are almost unlimited. R. A. E.

667.752.2

974. Varnish and Lacquer Diluents from California Petroleum. A. Lazar. *J. Ind. Eng. Chem.*, 1936, **28**, 658.—The use of liquid SO_2 for the production of concentrated aromatic fractions from petroleum distillates by solvent extraction has enabled a range of diluents to be prepared as substitutes for the general coal-tar products, toluene, xylene, industrial xylene, and heavy solvent naphtha.

The aromatic fractions obtained by SO_2 extraction are shown to require refining to remove nitrogen bases and sulphur compounds, organic acids and small amounts of unsaturated hydrocarbons in order to produce satisfactory low-coloured stable oils. The products are shown to be superior to mineral spirits, and to approach the coal-tar diluents in solvency power for oleoresins, synthetic resins and cellulose-ester varnishes. F. E. A. T.

66.094.41 : 608.3

975. Patents on Special Products. Bataaf. Petr. Mij. E.P. 446,411, 29.4.36. Manufacture of halogenated hydrocarbons by the addition of a halogen to an alkene, *e.g.* ethene, propene, etc., the reaction being carried out in the presence of water vapour and one or more complex cyanides, *e.g.* zinc, copper, aluminium or iron alkali or alkaline earth ferrocyanide or cuprocyanide and ferric chloride and/or aluminium chloride, at 250° C.

66.095.26 : 608.3

H. Standinger. E.P. 446,580, 1.5.36. Manufacture of polymerization products by polymerizing a mixture of styrene and divinylbenzene.

66.094.5 : 608.3

J. W. C. Crawford and I.C.I., Ltd. E.P. 446,908, 7.5.36. Manufacture of amides by heating a ketone cyanhydrin other than acetone cyanhydrin with sulphuric acid, oleum or an alkyl sulphonic acid to 140° C. The resultant mixture is then heated with water and/or alcohol to produce the corresponding unsaturated acid and/or ester. An anti-polymerizing agent such as copper or bronze powder, sulphur, or resorcinol, etc., is added.

66.094.5 : 608.3

J. Y. Johnson. E.P. 446,992, 11.5.36. Manufacture and production of organic sulphur compounds by reacting vinyl sulphones of the general formula $R(SO_2{\cdot}CH = CH_2)x$ with bisulphites of light metals, R representing an aliphatic radicle containing at least 7 carbon atoms and x is a whole number.

66.094.4 : 608.3

Bataaf. Petr. Mij. E.P. 447,876, 27.5.36. Production of halogenated organic acids from a halogenated ketone containing at least one halogen atom in the alkyl

radicle, by oxidation with nitric acid in the presence of water and/or a halogenated carboxylic acid.

678.049.3 : 608.3

D. D. Pratt. E.P. 448,105, 26.5.36. Preparation of stable mixtures containing rubber and pitch from rubber or vulcanized latex, coal-tars or hydrogenation products of coal-tars.

66.094.3 : 608.3

Carbide and Carbon Chemicals Co. and G. H. Reid. E.P. 448,145, 3.6.36. Purification of aliphatic monobasic acids by oxidising analdehyde, separating the acid formed by fractional distillation and subsequently treating the acid by aëration in the presence of a vanadium salt as oxidizing catalyst.

665.581.5 : 608.3

I.G. Farbenind. E.P. 448,242, 3.6.36. Manufacture of symmetrical di-arylamino hydroxy benzenes and aryl amino dihydroxybenzenes by heating symmetrical triaminobenzene in the form of an inorganic salt with a primary aromatic amine in the presence of water.

66.097 : 608.3

J. Y. Johnson. E.P. 448,269, 5.6.36. Manufacture of ethyl chloride by leading a mixture of ethylene and hydrogen chloride over a catalyst, *e.g.* activated zinc halide on a porous carrier. W. S. E. C.

Engines.

621.317.755

976. **Cathode-Ray Oscillograph Auxiliaries.** R. R. Batcher. *Instruments*, 1936, **9**, 140, 166.—The discussion of deflection amplifiers is concluded. The various means of translating the quantities to be measured, *i.e.* mechanical movements, acoustic or electric waves, etc., into electric potentials suitable for application to the cathode-ray tube are described. The recording of oscillograms photographically is discussed. P. D.

621.43-634.2 : 621.43.068

977. **Exhaust Filter for Diesel Engines.** Degea A-G. and the Daimler-Benz A-G. *Fuel*, 1936, **18**, 153.—The problem of deodorizing the exhaust gases from oil engines used in road vehicles has been investigated, and an apparatus is described which, it is claimed, is effective.

The apparatus replaces the usual silencer and contains a granular filtering medium, one function of which is to effect the catalytic combustion of the partly burnt and unburnt constituents of the gases. The filter has, in addition, a high power of absorption, which is necessary when the temperature falls below that of the catalytic reaction. The absorbed material is retained until the temperature rises, when it is removed by the catalytic oxidation.

It is claimed that the filter gives little trouble in service, and has an inappreciable effect on the performance of the engine. J. G. W.

Detonation.

621.43.019.6

978. **High-Speed Motion Pictures of Engine Flames.** G. M. Rassweiler and L. Withrow. *Ind. Eng. Chem.*, 1936, **28**, 672.—A transparent quartz plate, mounted in the combustion chamber of an engine, was used to obtain an unobstructed view of the combustion process. A special camera is described in which the film and image are moved in synchronism by means of a lens system driven from the engine crankshaft.

The camera is capable of taking a series of thirty photographs at rates up to five thousand pictures per second.

A set of flame pictures taken with the apparatus is given, which indicates the manner in which the combustion is propagated. J. G. W.

621.43.019.3

979. Knocking in Motors and the Action of Anti-knocks. J. Lorentzen. *Fuel*, 1936, **15**, 166.—A cylindrical combustion chamber was used to investigate the nature of knocking in hexane and pentane mixtures. The apparatus included means for recording the pressure during combustion, and it was possible to start ignition from various points in the combustion chamber to obtain information regarding the speed of flame propagation.

Variations in the mixture strength showed that when knocking occurred, reactions other than those associated with smooth combustion were taking place. Knocking was apparent by a marked vibration on the pressure–time records.

It is shown that knocking occurs if the propagation of the flame does not complete combustion, in which case the partly burnt mixture behind the flame front may be brought to its self-ignition point by a pressure wave reflected from the combustion chamber wall. It is shown also that the speed of flame propagation was about twice as great with knocking mixtures as in mixtures in which knocking was absent. Turbulence in the mixture was found to increase the speed of combustion and to eliminate knocking at the lower initial pressures.

The addition of anti-knocks to the fuels was not effective in suppressing knocking, but if the products of combustion of the anti-knocks were admitted to the combustion chamber prior to ignition of mixture, the initial pressure could be increased before a knocking explosion occurred. J. G. W.

Coal and Shale.

665.581.5

980. Production of Petrol by the Hydrogenation of Coal. Part II. F. E. Smith. *Engineer*, 1936, **161**, 659.—The previous paper having dealt with the chemical processes and main characteristics of the Imperial Chemical Industries plant at Billingham for the hydrogenation of coal, this one deals with special features involved in the design of the plant. An account is given of some of the main difficulties involved in the construction of the plant and the manner in which they were overcome. Ordinary carbon steels, when exposed to hydrogen at elevated temperatures and pressures, are liable to decarburization and embrittlement, the rate of attack being a function of the composition of the steel, the partial pressure of the hydrogen, the temperature, and the stress in the steel. Accordingly special alloys have been employed, which have been found to be resistant to hydrogen attack at elevated temperatures and pressures. H. E. T.

661.581.5

981. Carbonization of Coal–Oil Mixtures. D. Brownlie. *J. Ind. Eng. Chem.*, 1936, **28**, 629.—The paper reviews the developments over the past twenty years of the various processes for the carbonization of coal–oil mixtures, and in particular the more recent Bluemner, Carbonol, Knowles, Mitford and Stephenson processes.

The processes are grouped into two classes: (1) carbonization at atmospheric pressure and at temperatures up to 1200° C. depending on the nature of the residue required, and (2) carbonization under pressure, the pressure being as much as 200–300 lb./sq. inch, with temperatures up to 500° C. A brief outline of the development of each process is included, together with such data as are available regarding yields. F. E. A. T.

662.758 : 608.3

982. Patents on Coal. E. Bluemner. E.P. 446,357, 29.4.36. Production of colloidal fuel and low-boiling hydrocarbons from solid bituminous fuels. The original material is subjected to heat and pressure in successive heating zones and the reaction products are passed from each heating zone to a succeeding unheated chamber to allow a separation of liquid and gas-vapour phases.

662.74 : 608.3

A. A. Roberts and J. E. Hackford. E.P. 446,412, 27.4.36. Improvement in coal distillation in which bituminous-coal of fixed carbon content not above 50%, is

admixed with sodium or calcium borate and sodium chloride and heated externally in a retort to 750° C.

662.74 : 608.3

C. View. E.P. 446,494, 446,617, 28.4.36. Activation of coal for subsequent hydrogenation by heating the coal in a comminuted state in the presence of a basic reagent, *e.g.* alkaline or alkaline-earth metals or their oxides, carbonates or hydroxides or ammonia at 150° C.

662.74 : 608.3

H. P. Stephenson. E.P. 448,028–9, 29.5.36. Distillation and carbonization of coal–oil mixtures to increase the yield of light products for use as solvents in the lacquer, paint and rubber industries. The coal–oil mixture is stirred at 100–325° C. and carbonized in a stationary retort at 450–650° C. The heated volatile products are passed through a heated tube containing, as catalyst, zinc dust or alkaline earth with a carrier. W. S. E. C.

Economics and Statistics.

658.78 : 665.54

983. Price of Crude Oil in Perspective. J. E. Pogue. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 810–815.—Variations in the price of crude oil over long periods are analysed. It is shown that there have been 5 important phases, which are dated as follows: 1859–1877, 1878–1915, 1916–1920, 1921–1926 and 1927–1935. The first phase, which corresponds to the birth and early growth of the industry, is marked by violent fluctuations in price, these fluctuations dying down towards the end. The second phase is marked by stability and low average levels, whilst the third phase is in marked contrast to that, it being the period of inflation during the World War. The fourth phase is the time of deflation after phase 3, and the fifth phase is the logical outgrowth of phases 3 and 4, its dominant feature being proration.

Comparison of the price of crude oil with the price of 30 basic commodities over this period shows considerable similarity between the two curves, thus indicating that the price of crude oil is influenced by the same economic forces that affect other commodities. S. E. C.

665.5(495)

984. Petroleum Imports into Greece During 1935. N. Mănescu. *Mon. Petr. Roum.*, 1936, **37**, 671–674.—The imports of petroleum into Greece have augmented considerably since 1930. A total of about 244,000 tonnes were imported in 1935, and nearly 73% of this quantity was furnished by Rumania and 25% by the U.S.A. The latter country supplied the bulk of the lubricating oils imported. The value of the petroleum exports of Rumania to Greece represents 31% of the total value of all exports from Rumania to Greece. Kerosine can be imported without restriction into Thrace and Macedonia, but elsewhere it constitutes a Government monopoly. Lubricating oils and greases must be imported from countries with which Greece has favourable trade balances or commercial agreements. Other petroleum products may be imported without restriction at the present time. The decree regarding lubricating oils explains the fact that England exported about 800 tonnes of these oils to Greece in 1935, and also accounts partly for the U.S.A. figures. W. E. J. B.

BOOKS RECEIVED.

Books Received.

622.337.2(81)

ROCHAS OLEIGENAS DO BRASIL E SEU APROVEITAMENTO. S. Fróes Abreu. Pp. 159. 1936, Instituto Nacional de Technologia, Rio de Janeiro.

Authoritative information on the existence of oil-shale in Brazil is summarized, together with remarks on its utilization. Attempts in the past to utilize the shale have met with little commercial success, and a chapter is devoted to the pioneer enterprises. The chemical and physical analysis of various shales are given and the fundamental conditions for the establishment of a shale-oil industry in Brazil are discussed. Although the distillation of oil-shale may not offer great profit as a commercial venture, it has an important bearing on the problem of national defence.

622.6

SYMPOSIUM ON INDUSTRIAL FUELS. Pp. v + 70. 1936, American Society for Testing Materials, Philadelphia, Pa.

This contains papers presented at a Joint Meeting of the A.S.T.M. and the Engineers Club of Philadelphia in January, 1936, and includes: "Coal and Coke: Occurrence, Testing and Utilization," by A. C. Fieldner and W. A. Selvig; "Industrial Fuel Oils," by H. V. Hume; "Manufactured Gas," by P. T. Dashiell and F. H. Trembly, Jr.; "Liquefied Petroleum Gas," by W. H. Bateman.

662.98 621.431.74

INSTITUTE OF MARINE ENGINEERS. TRANSACTIONS, Vol. XLVII, 1935–36. Pp. xlviii + 401.

Included in this volume are papers on: "Some Notes on Heat Transmission," by E. F. Spanner; "Welded Steel Frames for Marine Engines," by C. H. Stevens.

658.2 : 665.4/5(729.87)

TRINIDAD. ADMINISTRATION REPORT OF THE ACTING INSPECTOR OF MINES FOR THE YEAR 1935. Pp. 14, 9 charts. 1936, Government Printer, Trinidad. 84 cents.

Details are given of the petroleum and asphalt industries of Trinidad. The production of crude petroleum in 1935 was 10,993,540 barrels, as compared with 9,981,774 barrels in 1934. The output of asphalt also increased from 92,829 tons in 1934 to 134,578 tons in 1935.

The total capacity of the six main refineries is 2,366,300 tons per annum, while the main tank storage capacity is approximately 4,085,000 barrels.

658.2 : 665.451(02)

BITUMEN AND PETROLEUM IN ANTIQUITY. R. J. Forbes. Pp. viii + 109. 1936, E. J. Brill, Leiden, Holland. F. 2. ($1.25 : 5*s.*)

This book presents in a concise form the most reliable data available on the utilization of bitumen and petroleum in antiquity. Some of the old mastics, the application and data of which were known, have been analysed and the results tabulated. The areas in which the bitumens were found are dealt with and the methods of collecting and refining the raw material are discussed. Various applications of bitumen receive attention and many illustrations of the methods employed are given. A bibliography of 160 entries is appended.

665.52(02)

DISTILLATION. Joseph Reilly. Pp. viii + 120. 1936, Methuen & Co., London. 3*s.* 6*d.*

This is one of Methuen's Monographs on chemical subjects and summarizes recent developments in the theory and practice of various aspects of distillation. After an

introductory chapter the following subjects are discussed: Fractionation; Production and Measurement of Low Pressure; Vacuum Fractionation; Azeotropic Mixtures; Distillation in a Current of Steam; Destructive Distillation; Sublimation.

669.14 656.61 + 622.608

INSTITUTION OF MECHANICAL ENGINEERS, PROCEEDINGS, Vol. 131, 1935. Pp. xi + 656.

Included in the papers published in this volume are: "The Utilization of Creep Test Data in Engineering Design," by R. W. Bailey (pp. 131–269); "The Embrittlement of Alloy Steels," by Prof. F. C. Lea and R. N. Arnold (pp. 539–588); "Bulk Handling of Petroleum," by J. T. Graham (pp. 603–609).

U.S. Bureau of Mines:

622.324.5

MONOGRAPH 7. BACK-PRESSURE DATA ON NATURAL-GAS WELLS AND THEIR APPLICATION TO PRODUCTION PRACTICE. E. L. Rawlins and M. A. Schellhardt. Pp. vi + 210. 1936, Superintendent of Documents, Washington, D.C.

This report supplements the information contained in previous Bureau of Mines publications, and presents a more extended discussion of the subject-matter. Recommendations are given concerning procedure for obtaining data and analysing results that are more practical and easier to use. It also includes an analysis of the application of back-pressure data to gas-production problems.

622.324.5

REPORT OF INVESTIGATIONS 3303. COMPARISON OF OUTPUT AND INTAKE CHARACTERISTICS OF NATURAL-GAS WELLS IN TEXAS PANHANDLE FIELD. M. A. Schellhardt and E. L. Rawlins. Pp. 25. 1936, Superintendent of Documents, Washington, D.C.

The output and intake characteristics of six natural-gas wells in the Texas Panhandle field have been studied and the data are supplemented by surveys of shut-in pressures of closed-in wells near three of those from which pressure and flow data were obtained.

55.03 : 608.3

REPORT OF INVESTIGATIONS 6883. PATENTS ON GEOPHYSICAL PROSPECTING ISSUED IN THE UNITED STATES, ENGLAND, CANADA, AUSTRALIA, GERMANY, FRANCE, AND RUSSIA. W. Ayvazoglou. Pp. 136. 1936, Superintendent of Documents, Washington, D.C.

Short abstracts of over 500 patent specifications relating to geophysical prospecting. These are arranged in groups according to country of origin and are further subdivided into sections relating to the method employed.

U.S. Geological Survey:

553(748)

BULL. 855. GEOLOGY AND MINERAL RESOURCES OF THE BELLEFONTE QUADRANGLE, PENNSYLVANIA. C. Butts and E. S. Moore. Pp. vi + 111. 1936, Superintendent of Documents, Washington, D.C. 50 cents.

The Bellefonte Quadrangle is a rectangular area of 230 square miles in Centre County, Pa., and the mineral resources of the area are relatively small.

553(792)

BULL. 865. GEOLOGY OF THE MONUMENT VALLEY–NAVAJO MOUNTAIN REGION, SAN JUAN COUNTY, UTAH. A. A. Baker. Pp. vi + 106. 1936, Superintendent of Documents, Washington, D.C. 60 cents.

The Monument Valley–Navajo region is part of the Colorado Plateau, and includes 1100 square miles in San Juan County, S.E. Utah. Oil seeps from the Rico and Hermosa formations at several places in the Canyons of the San Juan River, and small amounts have been produced from wells drilled near Mexican Hat, and in other localities.

551.702

PROFESSIONAL PAPER 183. CORRELATION OF THE JURASSIC FORMATIONS OF PARTS OF UTAH, ARIZONA, NEW MEXICO AND COLORADO. A. A. Baker, C. H. Dane and J. B. Reeside, Jr. Pp. v + 66. 1936, Superintendent of Documents, Washington, D.C. 50 cents.

This paper summarizes certain results obtained in recent field work in eastern Utah and adjacent parts of Arizona, New Mexico and Colorado and revises the interpretations and correlations of the Jurassic formations of the area as they are affected by these results.

ABSTRACTS.

	PAGE		PAGE
Geology	376 A	Motor Fuels	402 A
Geophysics	379 A	Kerosine	405 A
Drilling	385 A	Lubricants and Lubrication ...	405 A
Production	387 A	Paraffin Wax	408 A
Pipe-Lines and Transport ...	391 A	Fuel Oil	408 A
Chemistry and Physics	394 A	Asphalt and Bitumen	410 A
Analysis and Testing	396 A	Special Products	410 A
Refining and Refinery Plant ...	397 A	Combustion	411 A
Cracking	399 A	Coal and Shale	412 A
Hydrogenation	400 A	Economics and Statistics ...	413 A
Polymerization	400 A	General	414 A
Crude Oil	401 A	Reviews	415 A

AUTHOR INDEX.

The numbers refer to the Abstract Number.

Albright, J. C., 1062
Asprey, R. W., 1084
Atlantic Refining Company, 1084
Atwell, H. V., 1080

Baender, F. G., 1084
Baker, H. W., 1039
Batasdsche Petroleum Mij., 1080, 1084, 1095
Beard, L. C., 1063
Beck, H. V., 1015
Behar, G. K., 1033
Bennett, H. T., 1084
Betancourt, N., 1102
Beynon, L. G., 1086
Bignell, L. G. E., 991, 992
Blau, L. W., 1002
Borel, J., 1065
Boyd, J., 1002
Boyd, J. H., 1070
Brame, J. M., 1099
Brantly, J. E., 1010
Brassert, H. A., & Co., 1099
Bridges, R. B., 1027
Brown, G. G., 1074
Bywater, W. M., 1099

Campbell, A. W., 1050
Campbell, S. S., 1080
Carpenter, I. C., 1084
Cassidy, T. A., 1095
Challener, W. A. P., 1065
Clarke, L. A., 1084
Comay, S., 1080
Consitt, N., 1099
Cook, M., 1012
Cornahan, F. L., 1052
Corson, B. B., 1045
Cowell, R. E., 1099
Crawford, F. A. P., 1065
Cromwell, N. H., 1050
Crowley, H. G., 1084

Dietrich, K. B., 1077
Du Pont de Nemours & Co., E.I., 1095

Ehring, K., 1011, 1022
Erdheim, E., 1061
Erk, S., 1051
Evers, F., 1054

Ferris, S. W., 1084
Fisher, A., 1099
Flood, M. H., 1017
Flores, L. de, 1065
Fusstieg, R., 1069

Ganitaki, I., 1039, 1100
Gary, W. W., 1066
Gemmer, R. W., 1002
Gibson, G. F., 1096
Good, D. B., 1038
Gotting, H. E., 1099
Govers, F. X., 1084
Green, H. F., 1084
Groll, H. P. A., 1080
Gross, H. H., 1084
Grosse, A. V., 1043, 1068
Gruse, W. A., 1062, 1084
Gutehoffnungshütte Oberhausen A.-G., 1095

Hager, J. J., 1050
Haider, M. L., 1020
Hammerich, T., 1078
Heald, K. C., 1005
Hearne, G., 1080
Herpig, F., 987
Hieland, C. A., 996, 1000
Hjerpe, E. B., 1084
Houdry Process Corpn., 1065

Ihrig, H. K., 1013, 1032
Imperial Chemical Industries, 1065
Ipatieff, V. N., 1043, 1045, 1047, 1048, 1049, 1068

Jakosky, J. J., 1002
Jamieson, J., 1097
Johnson, J. Y., 1057, 1070, 1084

Kautter, C. T., 1095
Kelly, S. F., 998
Kemler, E., 1030
King, J. G., 1097
Kingman, D. G., 1028
Kistiakowsky, G. B., 1046
Komarewsky, V. I., 1043, 1048, 1049
Kornfeld, J. H., 997

Lachman, A., 1080
Lander, C. H., 1098
Langlois, H. F. L., 1084
Langlois, H. N., 1084
Lichti, —, 1076
Livingstone, O. A., 1082
Logan, K. H., 1036
Lohrengel, W., 1077
Luca Muro, F. P. de, 999

McCarty, B. Y., 1084
McCullough, G. W., 1031
McGary, S. U., 1037
MacGregor, J. R., 1088
McNiel, C. P., 1093
Maillard, A., 1055
Malisoff, W. M., 1080, 1084
Manley, R. E., 1084
Martin, E. J., 1084
Mears, W. H., 1046
Mellersh-Jackson, L., 1084
Merrill, D. R., 1084
Migaux, M. L., 989
Mills, B., 990, 1003, 1004, 1009, 1019, 1026
Moll, F., 1094
Moorman, A. R., 1084
Moritz, B. E., 1002
Morrell, J. C., 1080
Morris, A. B., 1023, 1025
Müller, D. R. W., 1064

Neumann, E., 1091
Nieuwland, J. A., 1044

Osgood, W. H., 1021

Page, J. M., 1085
Parsons, C. P., 1018
Payne, C. R., 1080
Penniman, W. B. D., 1095
Peters, F. N., 1036
Petroleum Processes Company (France), 1089
Pew, A. E., 1073
Pier, M., 1066
Pines, H., 1043, 1045, 1047, 1049
Prickett, T. B., 1065

Rather, J. B., 1063
Ravenscroft, E. A., 1060
Rendel, T. B., 1087
Riemenschneider, R. W., 1084
Ringer, F., 1066
Roberts, J. K., 1066
Ross, J. S., 1007
Ruthruff, R. F., 1066

Scheumann, W., 1075
Schulze, W. A., 1080
Sequin, A., 1103
Sewell, J. L., 1072
Simon, W., 1066
Simons, O. F., 1080
Smiley, T. F., 985, 986
Smith, J., 1099
Smith, R. L., 1041
Snake, H. R., 1092
Soc. D'Exploit. des Cables Electriques Systeme Berthoud Borel et Cie., 1065
South, J. A., 1008
Sowa, F. J., 1044
Sparks, W. J., 1084
Standard Oil Development Co., 1084
Steiner, L., 1053
Stephenson, H. R., 1067
Stevens, D. R., 1080
Storey, Le R. G., 1080
Stratford, W. M., 1080
Strieter, O. G., 1092
Sullivan, F. W., 1066
Swindell, F., 993, 1035

Taylor, F. B., 1034
Teis, K. R., 1006
Terakopoff, R. G., 1080
Thomas, R. M., 1095

Underwood, A. J. V., 1065

Voorhees, V., 1086

Ward, J. T., 1066
Watson, K. M., 1041
Wegrin, J., 1101
Wellard, R., 1042
Wilder, N. M., 1024
Wilhelm, V. H., 1016
Williams, N., 1014
Wilmot & Cassidy Inc., 1095
Winning, C., 1084, 1095
Woods, G. M., 1071
Wunderly, H. L., 1044

Young, P. L., 1084

Zublin, E. W., 1066

Geology.

551.16 + 550.361

985. Relation of Depth to Variations in Rock Pressures and Temperature. T. F. Smiley. *Oil & Gas J.*, 2.7.36, **35** (7), 44.—In ordinary conditions rock or the natural pressure in a stratum below the earth's surface is taken as the same as hydrostatic pressure for that depth, but, in fact, there are wide variations. W. H. Osgood gives as a basic unit the calculation that a column of fresh-water 100 ft. high exerts a pressure of 43·4 lb./sq. in., and states that pressures for other depths are determined by multiplying the number 43·4 by the height of the water column in 100's of feet. For fluids of greater density (salt-water, mud fluid, etc.) or fluids of lesser density (oil, etc.) the pressure of the fluid column is found by multiplying the fresh-water pressure for that height by the sp. gr. of the fluid under consideration. For gas or air-column pressures, the reference unit is the atmospheric pressure of the air or 14·69 lb./sq. in. at sea level. C. E. Van Ostrand says that beneath the earth's surface in temperate zones a rather uniform temperature of about 50–60° F. exists at depths of 50–60 ft., increasing about 1° for each additional 50–70 ft.

Almost all strata overspreading oil deposits are argillaceous rocks; their thickness required to retain a petroleum deposit depends on the gas pressure that exists in the petroliferous stratum. If the covering is a soft pliable rock, not easy to fracture, it is more effective than a hard brittle or jointed bed. Most large oil-fields are relatively deep, and are held down by adequate thicknesses of argillaceous beds, not easily fractured, but usually able to close any fractures which may occur in them.

Rock pressures are summarized by one observer as follows: The Reservoir pressure called rock pressure is the resultant of pressures applied on the reservoir rock and the fluid pressure. B. F. N. M.

552.122

986. Sand Thickness Map is More Trustworthy than Structural Map. T. F. Smiley. *Oil & Gas J.*, 2.7.36, **35** (7), 46.—The heading is the gist of a communication from T. M. G., a well-known operator. He says he has made and studied hundreds of columnar sections of well logs, and is struck with the local convergence and divergence between identical horizons and its effect. A correct local structural map cannot be made in advance of a high percentage of well completions, and is often worthless unless based on the producing horizon. A regional structural map which is based on surface formations or widely separated sub-surface controls may have a degree of value in test drilling. In gently warped territory a sand thickness map made after a large number of well completions is of more value than a structural map. B. F. N. M.

553.061.3 + 622.323

987. Origin of, Search for, and Exploitation of Petroleum. F. Herpig. *Bol. Inform. Petroleras* (*B.A.*), Jan. 1936, **137**, 9–29.—This long article covers a wide range of petroleum technology subjects, from the origin of oil to a final account of the latest production methods. It embodies the discussions at a Conference held in November 1935, at which it was decided not to dispute theories, but to explain simply the generally accepted fundamentals of the present day as to the origin of petroleum. The Conference unanimously adopted the ideas put forward by Dr. E. Blumer. The article has about 18 sub-headings, a map and 2 figures, and goes to prove that the Y.P.F. is keeping abreast with all the newest developments in the oil industry, not only in its studies, but also in the actual use of the latest methods—as, for example, in their geological and geophysical organization they have employed the Torsion balance, the Seismographic, the Magnetometric and the Electric methods, Aerial Surveys, and all the latest photographic inventions. B. F. N. M.

553.982(43)

988. Methodical Development of German Exploitation. Anon. *Rev. Petr.*, 25.7.36 (693), 1205–1207.—German production in 1935 reached 429,678 tonnes of crude oil, with a rapid rise of more than 100% from 1929 to 1931 and about 100% from 1933 to the end of 1935, in 6 years the production having quadrupled. The 1935 production covers

about 12% of the country's requirements. In 1934 Germany consumed 40 litres of motor fuel per head of population, France 55 litres, England 144 litres and the U.S.A. 609 litres.

The Nieuhagen oil-field, as in previous years, furnished the bulk of the total production, Weitze and Oberg production was nearly the same as previously, but Volkenroda had fallen heavily. On the other hand, there were several new fields which contributed only a little to the 1935 production, since the wells were only completed during the year.

With the object of greatly increasing the rapidity of exploring Germany for indigenous oil resources, the 1934 Government programme instituted the granting of subsidies, and thereby doubled what could have been done by private German enterprise unaided. When the Reich put into execution its drilling programme, no expert would have expected, with reason, an early success in Germany, which is not an "oil country." At the end of 2 years five new productive zones were added to the well-known Oilheim–Berkhopen, Oberg–Nieuhagen–Obershagen, which new zones could become oil-fields. They are: Heide in Holstein, Gifhorn and Hoheneggelson–Molme in Hanover, Fallstein near Halberstadt and Forst in Baden. The importance of proceeding methodically in the prospecting work led to a collaboration and an exchange of geological and technical knowledge between the geologists of all the Companies, brought together within an Institute of Petroleum inaugurated in 1934, with the result that geological knowledge was enriched as greatly over wide expanses as it was over isolated oil-fields. Very important geological correlations are due to the discovery of the new fields. It was believed until now that oil was practically confined to the beds enclosing the Hanoverian salt domes, to the Zechstein dolomite of Thuringia in the Volkenroda group, but the following possibilities are now opened :—

(1) At Gifhorn the Wealdian petroliferous bed is found above the salt plug, as in the cap rock of the Texas domes.

(2) At Heide there is no salt dome or plug of the Zechstein, but a swelling of Permian saliferous clays. The upper chalk is directly transgressive on the Permian, and oil is found as well in the upper chalk as in the transgression contact. In addition, the Zechstein dolomite should be found in the enveloping clay beds at depths which can be reached.

(3) Fallstein confirmed the anticlinal theory, since there was beneath the Triassic anticline, outcropping at the surface, an anticline in the Zechstein, which gives the expectation—with the Zechstein dolomite—of finding oil in it.

(4) In the Baden country near Forst oil was found which was known in the Tertiary formation at Pechelbronn. It is established that it can be found in the dogger (Jurassic) and in the Rhaetic (Trias) in exploitable quantities.

The geological possibilities of in what formation one can find oil have thus been considerably enhanced, which is naturally very important to guide exploration.

B. F. N. M.

553.982(64)

989. The Search for Oil in Morocco. M. L. Migaux. *Ann. des Comb. Liq.*, May–June, 1936, **11** (3), 411–420.—The period from the end of 1929 to the beginning of 1934 was devoted to surface, stratigraphical, tectonic and geophysical studies. 25,000 m. were drilled, and the gusher of Tselfat was completed in March 1934. Yet two years later knowledge is far from complete, and successful development depends on the discovery of a reserve of two or three million tons of oil. Since 1934 six wells have been drilled at Tselfat, with an aggregate depth of 2800 m., and have shown the beds to be broken and partly invaded by sulphurous water, whilst the reserves are probably only one-twentieth of what would be necessary to give commercial success. Search has therefore been directed to finding the same limestone reservoir under better conditions.

New apparatus was obtained in September 1934 and February 1935. At the beginning of 1936, 10,000 m. had been drilled, six wells being finished, and six under way. All these wells are searching for the limestone which is productive at Tselfat, on structures with more cover and less fracturing. One group of wells is testing the crests of visible structures in the area between Petitjean, Meknès and Fès. The well at Bou Draa encountered a fault and was stopped at 1038 m. without reaching the limestone. The structure had no seepage, and at 180 m. quite a heavy oil was found, the initial production of this being 20 tons/day. A well 350 m. to the east, and now at a depth

of 850 m., should be near the limestone. A well at Djebel Ari, south-west of Bou Drar, is at 575 m., and a well at Djebel Tratt has reached a depth of 500 m.

Other wells are searching for the limestone at depth on the faulted flanks of the preceding structures. One such well at Tselfat met the limestone at 1782 m., deeper than oil is expected.

A third group of wells is searching for the limestone under the younger (Cretaceous), discordant cover. This group is important, for three-quarters of northern Morocco, notably all the Rharb and the zone between Ouergha and Sebou, are so covered. A well which has stopped at a depth of 2007 m. has revealed very complicated tectonic conditions.

Other work is directed to studying the beds below the productive horizon, and to the examination of the Tertiary sandstones of the Rharb. Several shallow wells at Djebel Outita have all obtained more or less important shows of oil on a fold which has no surface traces of oil.

There is hope that the limestone of Tselfat will be productive elsewhere.

Five years would have been necessary to test the Moroccan potentialities thoroughly, for progress is necessarily slow; but the acquisition of new equipment is permitting acceleration of the exploratory programme.

A tectonic map is attached which gives the sites of the various oil indications.

G. D. H.

553.982 : 56(76)

990. Palæontology Playing Increasingly Important Rôle in Gulf Coast Drilling. B. Mills. *Oil Weekly*, 20.7.36, **82** (6), 19.—It is only within recent years that the importance of palæontology has been realized by operators in the Gulf Coast region. Deep drilling made it necessary to identify reliable marker horizons, and the first discovery of foraminifera was at 4000 ft., in what was later identified as the Middle Oligocene. Micropalæontology cannot be used above 2800 ft., but below this depth several markers can be definitely identified. Once a number of wells have been drilled in an area it is possible, by use of this science, to indicate the depth at which certain major formations will be penetrated, and even to predict the presence of a fault should a marker horizon show a marked difference in depth in two adjacent wells.

Operculina vaughani (Cushman) and *Camerina moodybranchensis* (Gravell and Hanna) are abundant in a 50-ft. section of the Moody's Branch marl, Jackson Eocene in an area extending from Waller Co., Texas, eastward into Florida, and within this area can be traced to at least 7000 ft. The Jackson is so deep along the Gulf Coast that the foraminifera in the Oligocene are chiefly considered. J. A. G.

553.982(766)

991. Coal County Well has Shallow Production in Atoka Horizon. L. G. E. Bignell. *Oil & Gas J.*, 16.7.36, **35** (9), 32.—Production has been found in Coal Co., Oklahoma, at a depth of about 800 ft. in the Atoka formation of early Pennsylvanian age. The Atoka outcrops here and dips N.E. at between 11 and 14 degrees. It is thought that accumulation is against a fault-plane which occurs just south of the discovery well. The Atoka consists of alternating sandstones and shales with a few impure basal limestones. Several of the sandy horizons are known to be gas and oil saturated, although prior to this discovery production had been negligible. Towards the McAlester Coal Basin the Atoka thickens considerably, and at Coalgate a well is reported to have drilled 8000 ft. of it without reaching the base.

Production from the well in Coal County is about 80 brl. per day from 11-inch casing, and it is planned to deepen the well to test formations known to be productive at the Jesse and Fitts fields which lie to the N.W. J. A. G.

553.982(766)

992. Big Wells do not Necessarily Mean Big Oil Reserves. L. G. E. Bignell. *Oil & Gas J.*, **35** (10), 23.—Four new and very prolific wells completed in the Moore and Crescent fields, Oklahoma, have added only a total of 650 acres to the producing area. All the fields in this part of Oklahoma, except the Crescent pool, lie to the west of a major fault extending from the Moore field to the northern State line. The pre-

Pennsylvanian sediments were deposited over the Nemaha Granite Ridge and subsequently fractured, the western side being downthrown. The main Crescent field is located to the east of the fault, but a gas well on the other side has slowly been increasing its oil yield, and it is probable that as the gas is being exhausted the oil is being gradually driven up-dip towards the well. Production is from the second Wilcox sand, and the steep dip on both sides of the fault limits production to a comparatively small area, water having been found immediately below the oil, and not far from the fault in both fields. J. A. G.

553.982(766)

993. Greater Seminole Ranks High. F. Swindell. *Oil Weekly*, 13.7.36, **82** (5), 131–132.—In a period of ten years the Seminole district of Oklahoma will have yielded more than 790,000,000 brl. of oil from about 38,000 acres. The discovery well of the Earlsboro pool was completed in March 1926 in the Earlsboro sand at a depth of 3560–3580 ft. A few days later the Seminole City pool was opened up with a production of 1100 brl./day from the Hunton lime, topped at 3975 ft. Some weeks later St. Louis was discovered, giving production from the Simpson dolomite at 4090–4290 ft., and the Searight pool began by producing from the Hunton lime at 4090–4157 ft. The Hunton lime was the centre of interest, but in July 1926 the Wilcox sand was encountered at 4258 ft. in the Seminole City pool. A few days later a second well gave production at the rate of 6120 brl./day from the Wilcox.

The Seminole district is on the Hunton Arch, which is probably related to the Ozark uplift. There is considerable structural irregularity, and even now some differences of opinion exist as to structural conditions in the Wilcox sand. The Pennsylvanian rocks appear at the surface as a gentle westward dipping monocline with many local irregularities. En echelon faults of small displacement (seldom over 50 ft. vertically) run at N. 35–40° W., and do not seem to affect the beds below the Pennsylvanian.

Daily oil production is now about 150,000 brl., there being about 10 brl. of water/brl. of oil. Water encroachment has been serious in most of the older pools, and many of the younger pools have been robbed of their original formation pressure. The district is well down the decline curve. G. D. H.

553.982(83)

994. Chile Testing. *Oil Weekly*, 13.7.36, **82** (5), 126.—After a lapse of four years exploratory drilling for oil is to be resumed in the southern territory of Magellanes, Chile. Well R-2 at Tres Puentes was completed in 1931 for an estimated initial output of 2 tons of oil per day. Its depth was 1180 m., but production was thought to be from a sandstone, possibly Oligocene, between 400 and 600 m. deep. This well is to be re-completed and additional wells are to be drilled in the neighbourhood. Tres Puentes or Punta Arenas is an anticline about 8 km. north of the city of Magellanes. A small oil seepage and several gas seepages occur near its crest, along which are several local domes. A second well drilled on this structure was dry.

A wildcat is to be drilled in the region of Chabunco on the basis of preliminary geological work. G. D. H.

Geophysics.

550.83

995. Principles and Practical Results of Geophysics. Anon. *Petr. Times*, 1936, **36**, i–xlviii.—This is in the nature of an up-to-date manual, divided into six main sections:—(1) *History of Geophysics.* This section begins by stating that, since prehistoric days, the search for useful mineral substances was conducted by methods necessitating actual contact with the desired minerals, until the arrival of geophysics applied physical measurements to studying the sub-surface constitution of the earth. The industrial use of geophysics started about 1920. Credit is given to the earliest pioneers together with their native countries, and then to the evolutionists of the instruments and methods now in use for the Magnetic, Electrical, Gravimetric and Seismic systems.

The Magnetic Method was extensively used in oil prospecting from 1924 to 1928, thereafter being supplanted by other methods, it has been mostly used in mining. The rivalry between the gravimetric and the seismic method is mentioned, from which

rivalry the reflection technique was devised to supersede the refraction method and to take first place in the favour of U.S. operators above both the refraction and gravimetric systems.

(2) *Present Position as to Geophysical Methods Surveyed.* Under this heading a summary in two tables is given. The first is in three columns, headed: Methods—Normal Conditions of Use—Practical Difficulties. The second has two columns: Problems—Method of Study. In comments on each of the above four methods, it is emphasized that the operation of the torsion balance does not require any general scientific knowledge, as the work is methodical and always of the same technique, necessitating only conscientious deftness. Under seismic prospecting the two forms of refraction and reflection shooting are contrasted as to different technique, drawbacks, expense, value of measurements and different scope of work. The seismic is assigned the leading position in point of usefulness among the geophysical methods used in the U.S.A. to date. The comment on electrical prospecting is that it is the most adaptable and most general method, but because of this the technique is very varied and the working and the geological interpretation of the measurements very difficult, only to be carried out by experienced geophysicists.

(3) *Electrical Exploration of Drill Holes.* Eight pages are devoted to this section, which is illustrated by seven figures and several photographs. It is descriptive of the Schlumberger method, which is here called a relatively new geophysical technique, although it is also known as "electrical coring," having the same ultimate object as the mechanical coring of bore holes. The methods of operation, electrical resistivities of rocks, measurements of electrical resistivities in drill holes, spontaneous currents inside drill holes, measurements of spontaneous potentials in drill holes are all described and defined, and where necessary formulæ given, and then the equipment used and manner of using it explained. The application of the electric logs is discussed with specific instances of the successful results in various parts of the world, actual logs being figured showing porosity, or permeability, outlines on the left and resistivity outlines on the right, in one case showing a productive oil-sand passed through unrecognized by the drillers, but discovered by this method.

(4) *Geophysical Prospecting Technique.* Under this heading the various methods are described somewhat fully. The magnetic and gravimetric methods are linked together as "static," both being based on the natural field of force. The magnetic is only capable of detecting granite ridges and the raised parts of the crystalline substratum for the guidance of oil prospecting. It has detected and outlined serpentine intrusions with oil deposits in South-West Texas. The gravimetric torsion balance is described, with formulæ, and its principles. The successful result of a survey by it in Alsace is shown. The Nash Dome on the Gulf Coast was discovered by torsion balance, the history of its discovery being described. The gravimetric method is slow in measurements, needs detailed and expensive altimetry to correct topography in hilly districts and suffers from uncertainty about the density of the hills and mountains when working in such country. The static methods, relying on the study of the natural fields, are inapplicable to the survey of horizontal strata and of scarcely any use on gently dipping beds. The dynamic methods do not suffer from this defect, and they can adjust at will a variable investigation depth, which is an additional and great advantage over the static methods.

Electrical Methods. The theory of the resistivity method with a simple apparatus used in its application is explained with formulæ, and a picture of the Schlumberger Potentiometer is shown, and this section is concluded by giving the fundamental principle of the geological interpretation of the electrical prospecting results, followed by two instances of the application of the resistivity method: (1) to the Survey of the Alsace Potash Basin, and (2) in the Baku District, U.S.S.R., both illustrated by pictures, maps, logs, and sections. To Seismic Methods 8 pages are devoted, with several illustrative diagrams. In the general remarks the complexity of the propagation of the waves from the shot point is attributed to the number of the different types of waves in the neighbourhood of discontinuity surfaces. Theoretically the difficulties are nearly insoluble, but experience has proved that in practice elementary geometrical optics will show the way to efficient results. Seismic methods lack any such mathematical doctrine as the other geophysical methods possess, the mathematical theory of elasticity being only a first and rough approximation. After much detailed description of the procedure with this method, dip shooting, a recent seismic development for surveying steeply dipping structures, is explained, and the section

is closed with examples of reflection shooting in Tunisia, with figures of the oscillograms, and of dip shooting in Morocco, with the figure of the geological section obtained.

(5) *World-Wide Geophysical Operations and Results.* This is a necessarily incomplete classification of the work done and being done throughout the world, with maps and photographs. Some 18 areas of the world are dealt with.

(6) *World Geophysical Organizations.* This section mentions the principal firms and individuals specializing in geophysical work (outside of the oil companies which have their own geophysical staffs) in the U.S.A., France, Italy, Denmark, Germany, Poland, Sweden and the United Kingdom.

The future of geophysics is dealt with from two aspects: the improvement in techniques and the development of their use. With regard to the first, geophysics is in its infancy, and there is a vast field to be explored with the expectation of the evolution of improvements in methods and the invention of new instruments. Electric and seismic methods appear to have the greatest possibilities, not being limited, as are the static methods, to the measurement of natural energy. It is suggested that the use of radiations by Hertzian waves or very penetrating X-rays may eventually be applied to geophysical research. Taking the second aspect, the solution of the problem of obtaining more certain and accurate knowledge of the geological structure at a relatively shallow depth was no sooner found than the problem of economically extending observations to a greater depth arose, and resulted in evolving new technique and the adoption of improved instruments. Finally it is confidently claimed that, used carefully and with judgment, geophysics pays, but should not be expected to perform miracles. It is a scientific tool to be used with circumspection. The geophysicist must have a little science, a lot of common sense, experience and perseverance, but above all the full confidence and amicable co-operation of geologists and engineers.

B. F. N. M.

550.83

996. Geophysical Mapping from the Air. C. A. Hieland. *Eng. Min. J.*, 1935, **136**, 609.—The author's object is to recount shortly what has already been done, and to suggest how aerial mapping may be adopted by some of the geophysical methods. As a very delicate apparatus requiring a firm foundation to obtain accurate results is essential, for instance in oil exploration, seismic and electric potential methods, which need a definite contact of the receiving units with the ground surface, would not afford as good possibilities of aerial operation and mapping as gravitational, magnetic and certain types of electrical methods.

The author then gives instances of attempts to obtain geophysical measurements from the air by magnetic methods. For gravity mapping the torsion balance would be unlikely to give satisfactory results from airplanes or airships, but other gravity methods could be used provided the effects of vibration could be eliminated or reduced. Progress in these geophysical methods has been made towards their perfection for use on moving vessels. The use of seismic methods is very doubtful, even at some future time. The difficulties of electrical prospecting from the air are discussed, and in conclusion it is pointed out that it will not be difficult to adapt some geophysical methods for use on a moving vehicle, although low flying and elimination of vertical or horizontal accelerations are difficulties which must be overcome. The advantages of aerial geophysical mapping will be the surveying of areas inaccessible to other methods, reduction of terrain and surface-geology effects, elimination of industrial electric and magnetic disturbances and improvements in interpretation methods by flying the same traverse in different altitudes.

B. F. N. M.

550.83(764)

997. Review of Petroleum Development in Texas. J. H. Kornfeld. *Petr. Eng.*, July, 1936, **7** (10), 31–141.—This long article is divided into eight parts, dealing divisionally with: (1) Coastal Texas, (2) East Central Texas, (3) East Texas, (4) North Texas, (5) Texas Panhandle, (6) South-West Texas, (7) West Central Texas and (8) West Texas. In the introduction attention is directed to oil production being obtained from 137 counties in this vast State, occurring in the entire range of geological sediments—with the exception of Cambrian, Jurassic and Triassic—from the Ordovician up to the Pliocene, and Texas now produces 44% of the U.S.A. crude oil output, and has the largest petroleum reserve. The article gives a detailed history

of each of the eight divisions. In (1) the Tomball field was a monument to geophysical exploration and was found by torsion balance. The Anhuac deep-seated salt dome discovery was due to reflection seismograph and torsion balance methods, and has proved the largest producer of the deep salt domes. The Schlumberger Electrical Surveying method is also largely used. Exploration of more than 60,000 acres has begun in Galveston Bay, with a fleet of 10 boats carrying seismic operators and apparatus. Gravel beds to a depth of 100 feet cause distortion velocities to the recording instruments unless shot points are drilled across a profile line and cased with 3-in. pipe. Routine practice utilizes shot points 40 ft. in depth. Deep tests drilled in exploration work have been useful recently for geophone tests to determine wave velocities. The geophone is lowered to the bottom of the hole and a charge of dynamite detonated at the surface. Correlation of unusual seismic pictures with those of known deep-seated domes is improving interpretation technique in recognizing anomalies of deep-seated domes, aided by correlation with regional minima as shown by torsion balance work.

(2) The Van oil-field, a so-called ideal oil-field, was indicated by the irregular dip at the surface of the Lower Claiborne strata, and was checked by the core drill and reflection seismograph—The Buffalo oil-field after the structure had been checked with geophysical instruments—Reflection seismograph work revealed the "high" in the Long Lake oil-field—Cayuga by reflection seismograph surveys—Red Lake structure was shown on torsion balance evidence.

Serpentine Production. Major faults in the Balcones fault system are associated with serpentine intrusions which represent peaks of weakness along regional fault displacements, occurring predominatingly on the upthrow side of local faults. Many of the larger plugs were successfully defined by the magnetometer. Not all serpentine plugs were proved to be productive, although local uplift by a serpentine plug intrusion may be responsible for oil in overlying formations, *e.g.* Chacon Lake oil-field. Up to January 1, 1934, a cumulative production of 15,700,400 brl. was recorded from 15 fields in serpentine or altered igneous material.

(3) The existence of favourable structure near Lodi, Marion County, Texas, proved by intensive seismograph geophysical surveys, led to the extension westwards from Caddo, Louisiana, into Cass County, Texas, of the large Rodessa oil-field.

(4) Seismograph exploration by obtaining anomalies of the salt-dome type and a shallow sulphur dome seem to prove the existence of a salt-dome basin. Like the Texas and Louisiana Coastal portions of the Gulf of Mexico embayment, a Miocene overlap of the Oligocene exists in the Rio Grande embayment, the indications being that a huge basin exists in North Mexico and that large oil reservoirs will have accumulated at the edge lines of the numerous sands in the Eocene, Oligocene and Miocene series. Due to the great thickness of gravel beds in the Rio Grande extension of the Reynosa escarpment which will be a hindrance to the reflection seismograph, the torsion balance, magnetometer and other geophysical methods will be more extensively used. Lack of surface mounds, although salt deposits exist, render detection of structure by surface geology almost impossible. After a reflection seismograph survey disclosed the structure, the Mercedes oil-field was discovered. B. F. N. M.

550.831 + 550.838

998. Exploring Down. S. F. Kelly. *Explosives Engineer*, 1935, **13**, 263–270, 303–312. —This paper deals in Part 1 mainly with the magnetic and gravitational geophysical methods. In the introduction it is pointed out that the physicist has only recently introduced to the geologist the study of rock reactions to external forces of various natures, and, by the collaboration of the two scientists, there has been produced the "hybrid science of geophysics."

The application of magnetic methods to prospecting is traced from early in the seventeenth century to date, and the operation and details of various magnetic instruments are described with the aid of diagrams and photographs. Three maps show the success achieved over the buried Amarillo Mountains in Texas with a fulfilled prediction of the zones of oil and gas productions.

Gravimetric methods, including the Eötvos torsion balance (which is shown in three figures), are then discussed, and some of the successes with this method in the American oil regions are mentioned before the author admits that the seismic methods have been proved to be the most rapid in searching for anticlines and salt domes, and

that seismic geophysics can map many features of geological structures down to a depth of 20,000 ft.

In Part II electrical methods are reviewed, in which reference is made to the Schlumberger apparatus and technique called "Spontaneous Polarization" and to the Schlumberger "Electrical Coring." After describing the application of various electrical instruments, the measurements obtained by them and the different exploratory purposes to which they can be put in oil, mining and civil engineering, the author concludes with briefly giving the advances made in interpreting the measurements of buried geological structure and in more accurately mapping it than could be done previously by surface geological work or from data obtainable from bore holes. Geophysics has now acquired a new and very valuable status as part of geological technique, thereby extending geology so that, being freely welcomed in its curriculum, geology will be made, by the help of geophysics, into a more exact and complete science.

B. F. N. M.

550.834

999. Possibilities of the Seismic Method in the Study of Elastic Reflected Waves. F. P. de Luca Muro. *Bol. Inform. Petroleras* (*B.A.*), April 1936, XII (140), 25–28.—Reference is made by the author to a previous article, in which he recommended research with the object of identifying the longitudinal and latitudinal waves and separating them the one from the other, and also the identification of the angles of emergence. It is now claimed that the piezo-quartz seismograph known as the Ambronn has succeeded in getting a reception of the reflected waves, by variation of the amplitude of the vibrations, eliminating the natural and artificial microseisms, and the large waves, and by limiting, in some cases, the filtrations. This application of the known electrical properties of quartz is not new, but Ambronn was the first to introduce it with success into Applied Geophysics, and by his seismograph has created the possibility of applying all the marvellous discoveries of modern electric technique to amplification, filtration and recording of electric oscillations. This evolution of an instrument susceptible of recording electric reflecting waves is very far from realizing perfection in seismic reflection methods, as has been shown by practical field tests. It was found that, according to the underground geological structure, an adaptation of the filter for each special case was necessary. The field work led to the conclusion that by applying the reflection method, the observer could utilize the times of arrival of the longitudinal reflection waves to procure a clear record of them, in consequence of the elimination, by means of filters, of the latitudinal waves of low frequency, without which elimination the latitudinal waves would have so confused the reception that identification of the longitudinal waves would have been impossible. When the latitudinal waves are of low frequency and the longitudinal of high frequency, it is very simple, by means of filters, to eliminate the perturbing frequencies. But in some areas the highest frequencies of the longitudinal waves are absorbed, leaving only the low frequencies, and then a system which eliminated or reduced the latitudinal waves of low frequency would defeat its object by eliminating or reducing as well the longitudinal waves of low frequency, thus creating the false impression that a horizontal reflector did not exist. Very thorough research on this problem has been undertaken by well-known geophysicists experimenting with new models of seismographs fitted with microphonic cells, and with the latest systems of mechanical, acoustic and electric filters. The progress of their work urges the author to stress the importance of close collaboration, or even alliance, of seismic and geo-electric research.

With the aid of a diagram, the author outlines the principles on which a process ought to be evolved whereby a good record of reflected waves could be obtained, and combining with that the fullest utilization of the seismic energy. It is pointed out finally that the extraordinary progress made in the field of electric measurements opens the door to the possibilities of great achievements by modern electro-technique, and that instrumentation, being of supreme importance in applied geophysics, is the reason for the great oil companies having organized special laboratories where apparatus invented therein are tested and all new inventions examined. B. F. N. M.

550.834

1000. Exploring with Explosives. C. A. Heiland. *Explosives Engineer*, 1935, **13**, 359–372.—This is an exposition of the development and application of seismic geo-

physical prospecting. The principles of refraction and reflection shooting are simply explained. A history of refraction and of reflection work, the first governed by station seismology in its instruments and interpretation methods, the second by progress in submarine and aerial sound ranging, traces the evolution of industrial demands for less expensive, deeper and more accurate results, which were eventually obtained from the reflection method, whilst the refraction method still retained its value and use for comparatively shallow measurements and for mining and civil engineering. The paper is well illustrated by 18 figures comprising charts, block diagrams, sections, seismograms, apparatus diagrams, and several photographs of the appliances and operation of seismic methods. Besides explaining the principles and procedure, several examples of refraction and reflection prospecting are given and the costs of the two methods are compared. Finally statistics of the yearly expenditure by the oil industry in the U.S.A. on seismic work and of the discovery successes by this system are tabulated. B. F. N. M.

550.837

1001. Earth Resistivity Method of Geophysical Surveying. Anon. *Petr. Times*, 1936, **36**, 151.—This article deals with the Megger Earth Tester, which is a method of geophysical survey based on the measurements of the electrical resistivity or specific resistance of the earth. The method particularly claims to determine the depth to bedrock for purposes such as buildings and dams, and to discover dykes, faults and bodies of mineral ore. Where the resistivity of the structure or of the rock which is being sought has a resistivity widely differing from that of the surrounding earth bodies, the Tester can be successfully employed. It does not claim to define the nature of the body causing resistivity variations, and a geologist must be called in to interpret its results. The method and operation of the instrument are described and illustrated by two photographs of the tester. B. F. N. M.

Patents on Geophysical Methods. 550.837 : 608.3

1002. Measuring Earth Resistance. J. Boyd and B. E. Moritz. U.S.P. 2,036,193, 7.4.36.—This invention has to do with ascertaining varying geophysical conditions of the subterranean areas by measuring differences in the electrical conductivity, which conditions may be concerned with ore bodies, fractured or broken zones, the thickness and extent of loose or alluvial material, or the presence of water and oil bodies.

This invention borrows from the prior art the use of a plurality of electrodes in electric circuits to ascertain the potential differences between the electrodes. Differing from other methods, in this invention the elements connected in the circuits co-operate to indicate directly the differences in electrical conductivity of the structure, without the necessity of subsequent calculation or computation, in a simple, accurate and practical manner, by devices sensitive to variations in the current flow through the circuits of which the electrodes are the ground terminals.

Another object is to include in the elements an amplifier voltmeter together with an adjustable resistance or other device of similar character. 1 Claim.

550.837 : 608.3

Method and Apparatus for Logging a Well. L. W. Blau and R. W. Gemmer. U.S.P. 2,037,306, 14.4.36.—The object of this invention is to obtain electrically data in bore holes to correlate strata having the same electrical characteristics over an area. Another object is to observe the presence of strata of different electric impedance from each other by measuring changes in frequency of current passing through the strata. It is claimed that by the procedure described, the frequencies recorded by the frequency meter, due to changes in the electrical impedance of the current path through the earth, are independent of the natural earth currents, so that the measurements recorded at any given depth within the well can always be easily and accurately duplicated. The apparatus records changes in frequency thereby differentiating between earth strata. 14 Claims.

550.837 : 608.3

Method and Apparatus for Alternating Current Investigation of Uncased Drill Holes. J. J. Jakosky. U.S.P. 2,038,046, 21.4.36.—In order to overcome the disadvantages

of the methods covered by U.S. Patents (Nos. 1,819,923, 1,652,227, 1,092,065 and 1,963,542) this invention employs a high-frequency alternating-current method for accurately measuring the impedance losses, power factor and the dielectric constants of the various strata penetrated by the drill hole. The procedure consists of lowering into the bore hole a cable carrying at its lower end two or more extended electrodes supported by an insulator spacer retaining them in rigid spatial relation to each other. They are also connected by insulated conductive wires passing through the cable from which they are suspended, with a source of alternating current at the surface of the ground and with a proper measuring apparatus. The dielectric and conductive material within the sphere of the electrodes consists principally of the earth materials surrounding the uncased bore hole and extending laterally in all directions to a considerable distance.

By changing the depth of the electrodes and making measurements at different depths, so as to measure an alternating current characteristic of different elementary portions of the penetrated earth formations, it is claimed to be possible to determine variations in the measured characteristic with regard to depth (preferably as a continuous record of said characteristic at varying depth) throughout any desired length of the drill hole and the earth formation penetrated thereby. 15 Claims.

B. F. N. M.

Drilling.

622.24

1003. Pollution Problem in Development of Submerged Leases along Coastal Belt. B. Mills. *Oil Weekly*, 25.5.36, 81 (11), 17.—A brief discussion of survey, drilling and production practices developed for marine operations in Louisiana, Texas and California. For drilling submerged structures steel barges are used. These carry permanently all equipment necessary to drill to 9000 or 10,000 ft. They are towed into position, sunk in the shallow bay waters and made the permanent well foundation. The barge is constructed to prevent contamination of the surrounding water, a reserve pit for the rotary mud being a feature of the design. The boilers are placed on a separate barge, which is also sunk in position. After completion of the well the barges are refloated.

L. V. W. C.

622.24

1004. Light Portable Rigs for Shallow Depth Holes. B. Mills. *Oil Weekly*, 4.5.36, 81 (8), 25.—The use of small portable rotary outfits has reduced drilling costs in two shallow West Texas fields producing from formations between 2500 and 3000 ft. deep. The draw works, motor, transmission and control are mounted on one set of skids, which in turn is mounted on a 2½-ton truck. The main unit weighs about 13,000 lb. The truck may be placed against the side of the derrick or the unit may be skidded and placed on a temporary foundation. The power is supplied by a 25/65-h.p. electric motor mounted with the unit. Chain-driven transmission is used, with a reverse and three forward speeds. A 7½ × 14 mud pump is used, but 6-in. liners have been installed because of the limitation of the 25/65-h.p. electric motor. The second mud pump unit is a 5½ × 12, and is also driven by a 25/65-h.p. electric motor. Each pump unit is mounted separately.

L. V. W. C.

622.24

1005. Deep Well Drilling Problems and their Solution. K. C. Meald. *Oil Weekly*, 8.6.36, 81 (13), 19.—A brief history of deep wells is given. The need for continued drilling of deep wells is obvious. The areas showing the best prospects for continued and future deep drilling are in the east, the deep-lying beds of Devonian, Silurian and Ordovician age such as the Oriskany, Clinton and Trenton. In south-west Oklahoma the Wilcox sand, which has yielded such a great part of the past production of the State, is probably 16,000 ft. or more below the surface. In Texas, Louisiana and California there are regions where rocks, of the same age, and presumably of the same general characteristics as those that elsewhere carry oil, are believed to be at 20,000–30,000 ft. or even greater depths. The advantages and disadvantages of rotary and cable tools for deep-well drilling are discussed. The various problems encountered include

utilization of shallow-pay indications, casing troubles, crooked holes, hard formations, heaving shale, cementing, mud-fluid, withdrawal of drill-pipe, blow-outs, coring and other means for testing formations. L. V. W. C.

622.243.13

1006. Pressure Completion of Wells in the Fitts Pool. K. R. Teis. *Oil Weekly*, 18.5.36, **81** (10), 93.—A description of the characteristics of the Fitts pool (Oklahoma) with its high formation pressures. The application of pressure drilling, using water or gas rather than mud-laden fluid is described. The advantages and disadvantages are discussed and details given of the special equipment used. The conclusion is reached that the additional expense (approximately $3.00 per foot) over conventional drilling is justified by the results obtained. L. V. W. C.

622.243.14

1007. Drilling-In Under Pressure in the Oklahoma City Field. J. S. Ross. *Oil Weekly*, 25.5.36, **81** (11), 24.—Drilling-in under pressure implies the use of a relatively light column of oil and gas. This prevents the saturation and clogging by mud fluid of deep low-pressure producing formations. The methods of drilling-in are described. L. V. W. C.

622.242.2

1008. Treating Water for Cooling Systems. J. A. South. *Oil Weekly*, 1.6.36, **81** (12), 37.—The factors involved in the corrosion of iron in water are discussed. Field tests for the analysis of water are described, together with treatments for the softening of hard waters. L. V. W. C.

622.243.5

1009. Advancements in Drilling-In under Pressure Feature. West Texas Completion Practices. B. Mills. *Oil Weekly*, 1.6.36, **81** (12), 18.—Adoption of pressure drilling for completion has eliminated contamination of porous oil zones and provides more accurate well logs. A similar method has been applied to cleaning out after shooting in a few fields. Although flush joint drill-pipe and pressure equipment are generally used, the practice may be described as drilling-in under control. Ordinary drill-pipe is used to some extent. Oil is used as the circulating medium and high-pressure gas is injected to ensure circulation and assist bringing the cuttings to the surface. Descriptions of different equipments and methods are given. L. V. W. C.

622.243.5

1010. Rotary Drilling Practices. J. E. Brantly. *Oil Weekly*, 18.5.36, **81** (10), 71.—A discussion of the function and importance of the bit, the weight carried on the bit, rotating speeds, mud-laden fluids, including pumps, steam pressures and power requirements. L. V. W. C.

622.243.5

1011. Rotary Equipment for Deep Drilling. K. Ehring. *Oel und Kohle*, 1936, **12**, 555–557.—The design of various types of rotary drilling bits is described in relation to their special applications. P. G. H.

622.245.1

1012. Welded Oil-Well Casing Joints. M. Cook. *Oil & Gas J.*, 28.5.36, **35** (2), 33.—The recent progress in welding casing is discussed and the effect of welding on grain structure and physical properties is described. It is admitted that from the standpoint of tensile strength there is no urgent demand for the development of welded joints for casing. Factors favouring welded joints include the trend towards the use of flush-joint casing, and the experience of leaky couplings in deep producing wells; but the main argument in favour of welded joints is the economic one. The standard threaded coupling adds to the expense of the casing. In addition, the use of flush-joint casing enables substantial economies to be made, savings in casing and drilling time being effected. L. V. W. C.

622.245.42 661.184.26

1013. Fibrous Materials in Cement and Mud Open New Field in Production Practices. H. K. Ihrig. *Oil & Gas J.*, 21.5.36, **35** (1), 98.—The loss of drilling fluid into porous formations, the contamination of the mud fluid by salt-water from high-pressure water sands, and the loss of cement slurry into porous strata are problems which have been combated recently by the addition of fibrous material to the mud and cement. Fibre-laden drilling fluid enables an effective seal to be formed on the porous walls of the hole, preventing loss of circulation and contamination by high-pressure brines. To prevent loss of the slurry in cementing jobs the fibre is mixed with the cement at the mill. The cement contains 2% by weight of fibre of various lengths up to ½ in. The use of fibrous material also prevents the sealing of a pay sand by the saturation with cement of the producing formation, when cementing an oil string.

Tabulated data are given showing quantities of Portland and fibred cement used, comparative compressive strength and sealing ability. L. V. W. C.

622.248.1

1014. Hazardous Fishing Job is Tackled by Gulf Engineers in the Orchard Field. N. Williams. *Oil & Gas J.*, 7.5.36, **34** (51), 46.—Description of the cutting out and recovering of stuck drill-pipe in which a succession of secondary charged gas sands presented an unusual problem. Details are given of the equipment and procedure. L. V. W. C.

Production.

532.522

1015. Measurements of Viscous Fluids. H. V. Beck. *Oil Weekly*, 8.6.36, **81** (13), 39.—The orifice meter of the sharp square-edge type is suited for the measurement of gases and mobile liquids, the variation of the coefficient of discharge being within the limits of accuracy of commercial measurement. With fluids of higher viscosity the degree of variation increases, a 10% change in coefficient being possible, due to viscosity change produced by alteration of temperature. Coefficient curves for square-edge and round-edge orifices were determined. The liquids used were molasses in various degrees of dilution and an oil, the viscosity and density of which were known over a wide temperature range. The results so far obtained warrant the statement that round-edge orifices may be produced with coefficients which are substantially constant. With orifices of this type, the need for constant observation of fluid temperature and for frequent viscosity determinations would be eliminated. L. V. W. C.

622.24 + 622.276

1016. Petroleum Development and Production in the Future. V. H. Wilhelm. *Min. and Met.*, 1936, **17**, 393.—Continual changes in the petroleum industry, especially the rapid diminution of proved oil reserves, call for new development methods to meet the case of the old fields which are uneconomical to operate under present methods of development and production. Directed drilling has now reached such accuracy that this new process should be used in the future development of structures with thin oil-sands and steep dips. California has had good results from directional drilling. In one case where the vertical thickness of sands was about 550 ft., wells drifted at an angle of 55° from vertical had more than 1100 ft. of perforated pipe in contact with the oil sands—virtually a pipe-line laid through the sands. These wells are remarkable for their great initial production and sustained life. Vertical-intended wells showed only a small percentage of the production of the directionally drilled wells. Advantages claimed for directionally drilled wells are: (1) Centralization of operations by using a small area from which to drill all wells. (2) Edge wells which are short-lived because of flooding by edge-water encroachment need not be drilled, as the directed well may penetrate the sand to the edge-water line and as the water encroaches be progressively plugged, and can continue with a long life of profitable production. (3) In a structure of suitable type one directionally drilled

well only will be required to obtain the production and drain the sand of three or four vertically drilled wells under present operating methods. (4) In addition to much greater drainage radius, directed wells will have larger holes made with the same size of bits used in vertical drilling. (5) In protecting a property line from offset draining only two directed wells need be drilled, and they would do the work of eight wells vertically drilled. (6) In a thin steeply dipping sand it would be possible to radiate wells so that the number of wells required to drain the sand adequately would be much less than with normal drilling. These advantages are illustrated by two figures. The author discusses repressuring oil zones by gas injection with a personal doubt of the economy of this method compared with water drive. He further suggests that with fairly depleted shallow fields, mining methods should be adopted, and in Fig. 3 indicates an adit with drifts under the oil-sand, drill holes upward into the oil-sand, insertion of perforated pipe, cemented in the underlying shale and a system of collecting pipes running into the main pipe which would convey the oil out of the adit. B. F. N. M.

622.245.593 622.276

1017. Problems in Improved Recovery. M. H. Flood. *Oil Weekly*, 8.6.36, **81** (13), 37.—The problems encountered in repressuring, water flooding and acidizing are discussed. The factors of importance in the analysis of such problems include structure and petrography of the oil-bearing rocks; porosity, permeability and saturation of the reservoir; chemical characteristics of the rocks, water, gas and oil. L. V. W. C.

622.245.593

1018. Flow of Oil in Fine-Grained Lime Formations Increased with Penetrating Acid. C. P. Parsons. *Oil & Gas J.*, 28.5.36, **35** (2), 26.—Acid treatment of calcareous formations is used to enlarge the drainage pores or channels in the producing sand. Hydrochloric acid is used, the full strength containing 30% HCl. The viscous nature of the spent acid of this strength and possibility of precipitation of salts render it desirable to use a more dilute acid—the strength used in practice varying from 7 to 15%. Research has shown that acid treatment of fine-grained pores with straight diluted acid results in a loss in permeability due to the clogging of pores with insoluble residues. A penetrating acid is described which has a lower surface tension than ordinary acid or oil. In consequence, it has greater wetting and spreading energy, flows and penetrates the formations more readily. The spent acid is not viscous, enabling a 15–20% acid to be used. L. V. W. C.

622.276 : 620.191

1019. Production Corrosion. B. Mills. *Oil Weekly*, 27.4.36, **81** (7), 19.—Damage from corrosion of production equipment in the sour oil-fields of West Texas and Southeast New Mexico has been reduced materially as a result of an extensive study of the action of hydrogen sulphide and salt-water under various operating conditions. Development of special alloys, less severe use of equipment that suffers from fatigue, use of wood tanks, special asphaltic paints for tanks, and more careful handling of salt-water have been factors in a programme that has increased the service life of all types of equipment. L. V. W. C.

622.276

1020. Productivity Index. M. L. Haider. *Oil Weekly*, 18.5.36, **81** (10), 126.—Various methods of determining the ability of an oil well to produce are discussed. The productivity index, which is defined as the barrels of oil produced per day per pound differential between static and flowing bottom-hole pressure, is discussed, and methods of determining it are outlined. Data from a number of wells in various Oklahoma pools are given. The productivity index is shown to be superior to the other measures of relative ability of a well to produce. It is indicated that if the tests are conducted properly the productivity index is constant with different rates of production. L. V. W. C.

622.276.2

1021. **Practical Value of Subsurface Pressure Surveys in Oil-Well Operations.** W. H. Osgood. *Oil & Gas J.*, 28.5.36, **35** (2), 44; *Oil Weekly*, 25.5.36, **81** (11), 29.—Sub-surface data provide valuable information for guidance in production problems. The items of practical value derived from sub-surface pressure surveys are divided into two classes: (*a*) items within the control of operators which affect the production of individual wells; (*b*) items which determine field and reservoir conditions, influencing production methods. Individual well data include:—initial formation pressure, productivity factor, potential production, fluid levels, tubing depth, effective depth of well, optimum production rate for greatest ultimate recovery and lowest lifting costs, change from gas lift to pumping, effectiveness of pumping equipment, compressor requirements for gas lift installations, cleaning out operations. The data for field and reservoir conditions include existence, extent and movement of gas cap, pressure maintenance to secure minimum lifting costs and regulate encroachment of gas and water, direction of drainage, probable areas of best production, compressor requirements for repressuring operations, available reserves. Each of these items is described and its significance discussed. L. V. W. C.

622.276.2

1022. **Movement of Petroleum in Reservoir Rocks.** K. Ehring. *Oel und Kohle*, 1936, **12**, 501–507.—Review of published work, chiefly of American origin, bearing on the theoretical and practical aspects of the subject.

Considerable attention is devoted to artificial methods of influencing the movement of oil to the bore hole. P. G. H.

622.276.4

1023. **Flooding Water Resources in Nowata, Oklahoma, Stripper Well Territory.** A. B. Morris. *Oil & Gas J.*, 7.5.36, **34** (51), 35.—Discussion of the problem of providing water for flooding operations. In this area the surface water supplies are limited. The salt-water from deep horizons, although available in unlimited quantities, has a high sulphur content, and is therefore corrosive; in addition, its precipitating mineral content is high, necessitating treatment to prevent it from sealing the input strata. L. V. W. C.

622.276.4

1024. **Repressuring Lime-Producing Areas in Kentucky.** N. M. Wilder. *Oil Weekly*, 8.6.36, **81** (13), 31.—The problems encountered in repressuring limestone reservoirs are different from those of sand reservoirs, on account of the variation in structure and permeability of the rock. Owing to the lateral and vertical discontinuity of permeability in the limestone, radial flow cannot be expected, and drainage becomes an important factor. In limestone repressuring directional flow trends are set up, which influences the system of pattern spacing. Individual patterns suited to each directional flow trend as determined by experimental pressure wells should prove more beneficial in limestone areas than the general straight-pattern five-spot and seven-spot types. Close well spacing has made primary recovery more efficient in limestone areas. L. V. W. C.

622.276.4

1025. **Large Water Source Needed if Mid-Continent Flooding Work to Extend over Wide Area.** A. B. Morris. *Oil Weekly*, 4.5.36, **81** (8), 20.—Water-flooding operations in the Mid-Continent, already successfully applied to the shallow Bartlesville sand pools of north-eastern Oklahoma and south-eastern Kansas, face a serious threat in the inadequacy of the local streams to provide continuously a sufficient quantity of suitable water for the extension of this method over wide areas. A water programme is discussed. L. V. W. C.

622.276.4

1026. **Pressure Maintenance—South Burbank Reacts Favourably to Steady Injection.** B. Mills. *Oil Weekly*, 22.6.36, **82** (2), 19.—The performance of wells in South Burbank

(Oklahoma) have been affected favourably by the steady injection of gas. A pressure maintenance programme is being developed as a community effort. This work has resulted in uniform pressure, slow pressure decline, and assurance of longer flowing life. L. V. W. C.

622.276.4

1027. Back-Side Crank Pumping. R. E. Bridges. *Oil Weekly*, 18.5.36, **81** (10), 105.—The advantages to be gained by close attention to the details of setting and alignment of rod-line equipment connected to back cranks of individual pumping units are outlined. The proper balancing of loads on the unit when one- to four-jack wells are pumped from it is discussed. Torque on the unit shaft is used as a basis for analysing these loads. It is shown that the best operating condition is attained when the torque curves are smooth, with a minimum difference between low and high torque. The savings derived from the adoption of the catenary curve principle in pull-rod line installations are emphasized. The two definite economies effected are the reduction of friction and elimination of hold-downs in low places. Formulæ and examples are given to show the relation between the various factors encountered in the design of sagging rod lines. L. V. W. C.

622.276.4

1028. Application of Multi-Cylinder Gas Engines. D. G. Kingman. *Oil Weekly*, 18.5.36, **81** (10), 116.—The operating characteristics and selection of gas engines for pumping are discussed. The need for uniformity in obtaining and recording manufacturer's performance data, using brake mean effective pressure, is emphasized. The use of vacuum gauge and tachometer in making "manifold depression" tests in the field are described. Cost and maintenance data are given. L. V. W. C.

622.276.4 + 622.276.95

1029. Combination Gas-Lift and Centrifugal Pump. H. W. Baker. *Oil Weekly*, 27.4.36, **81** (7), 36.—A combination of gas-lift and electrical centrifugal bottom-hole pump is described which is suitable for lifting the settled production from deep wells after reservoir pressure has declined until gas lift is no longer possible. The pump used consists of a 60-stage centrifugal pump, powered by a 97½-h.p. two-pole, 3600-r.p.m., 60-cycle motor. The motor, pump and protector are attached to a joint of 2-inch tubing and started in the hole. From 300 to 1000 ft. above the top of the motor a 2½-in. by 7-in. packer is inserted. The first joint of tubing above the packer is perforated at the collar end. Running the tubing is then continued, and the pump is suspended as close to the bottom of the hole as possible. Power is supplied to the motor through a cable, which is clamped to the tubing. The oil enters the pump intake and is propelled by the pump up through the tubing and out through the perforations in the top adaptor. It is confined in the annular space by the packer, and is then gas-lifted to the surface by a steady injection of gas through the tubing perforations. L. V. W. C.

622.276.4

1030. Economic Life of Sucker Rods. E. Kemler. *Oil Weekly*, 18.5.36, **81** (10), 51.—The evaluation of sucker-rod service and the determination of the economic life of any particular string of tools require a knowledge of the behaviour of the rods under operating conditions. To determine the replacement time for the rods it is necessary to have an analytical relation between number of failures and days of service. A study of field records of test strings of sucker rods indicated that the number of failures could be expressed in the form $N = bT^m$, where N is the number of the failure, T is the time for the nth failure, and b and m are constants. This plots as a straight line on log-log paper, and the slope of this line becomes m, the exponent of T. The coefficient b is shown to be equal to $\frac{1}{m^n}$, where T_0 is the time at which the first T_0 failure occurs. L. V. W. C.

622.324.5 : 658.787.6

1031. **Problems of Wet Gas Measurement and Regulation.** G. W. McCullough. *Oil Weekly*, 15.8.36, **82** (1), 64.—A discussion and classification of the problems encountered in the measurement of wet or casing-head gas. The solution of these is the proper installation and maintenance of meters, regulators, drips and meter runs. The meter run should be of such type that the plate can be readily inspected and tubes cleaned. The drips should remove a maximum of liquid and dirt.

L. V. W. C.

628.54 : 614.777

1032. **Progress in Salt-Water Disposal Programmes.** H. K. Ihrig. *Oil & Gas J.*, 30.4.36, **34** (50), 36.—The present trend is towards underground disposal. Formations having high porosity and low saturation are the most desirable as disposal areas. Salt-water may be returned to the low side of producing structures, effecting an artificial water flood and increasing the ultimate recovery of oil. The success of water flooding in Penna and Mid-Continent areas should lead to the encouragement of this type of water disposal in Mid-Continent fields. It is suggested that the disposal of salt-water be checked by the following data: salt-water analyses from the wells before and after starting the project, individual well productions and details of input water. It is generally considered necessary to condition the input water; iron in suspension or solution, together with excessive amounts of calcium carbonate, must be removed to protect the porosity of the formations. One type of disposal plant consists in a gathering system of asbestos cement pipe, a large concrete-lined pit equipped with baffles in such a manner as to cause a slow flow of water through the pit to permit the settling of suspended material and at the same time aerating the water. Another type in process of development uses an aerator with stabilizing filter. Hydrogen sulphide is removed by the aerator, and the stabilizing filter stabilized the carbonate content. Water with too low a carbonate content is liable to be corrosive, and may contain a high proportion of iron, which may be deposited in the formation. Water with too high a carbonate content will precipitate calcium carbonate in the pores of the sand.

L. V. W. C.

Pipe-Lines and Transport.

621.643.3

1033. **Cargo Hose Care and Maintenance.** G. K. Bedur. *Oil Weekly*, 15.6.36, **82** (1), 44.—Water transportation is being used to an increasing extent, and among the equipment problems is that pertaining to care and maintenance of cargo hose. Hose should be tested with water in excess of working pressure every two months. New hose should be generally used on gasoline or light oil at high pressures. With progressive service it should go into heavy oil or crude service at lower pressures. Wheeled dollies and rope slings facilitate the handling of hose and reduce wear. L. V. W. C.

622.698

1034. **Pressure Release Feed-back Overcomes Frequent Trouble on Pipe-Line Manifold.** F. B. Taylor. *Oil Weekly*, 15.6.36, **82** (1), 70.—A difficulty experienced in the operation of 10-inch and larger gates, due to considerable difference of pressure against the two sides of the tongue, can be eliminated by use of a feed-back. In making orifice plate changes, inspections, or repairs, it is necessary to bleed the run, and in order to repack, the valves controlling the run which have line pressure against one side of the disc, and atmospheric on the other, must be opened. The pressure difference tends to freeze the larger valves. The usual set-up on a compound run includes two blow-offs at either end, which are valve controlled. To utilize the pressure feed-back the blow-off valves at one end are connected to an overhead by-pass, one of the valves formerly used for bleeding is opened and also one of the valves on a run which is still pressured. This equalization of the pressure on both sides of the gate controlling the run allows its free operation.

L. V. W. C.

622.698 : 620.191

1035. Methods of Studying Pipe-Line Corrosion. F. Swindell. *Oil Weekly*, 4.5.36, **81** (8), 27.—An account is given of a recently completed corrosion study and reconditioning of a pipe-line. Resistivity surveys were made on the right-of-way after heavy rain and during dry weather. The line was uncovered, cleaned, and corrosion pits were measured. Where pipe penetration exceeded 100 mm. the pits were electric spot welded. Where pits were exceedingly frequent, the section was cut out and replaced by good pipe welded into position, or if the pitting was restricted to a small area, a patch was electrically spot welded. Samples of soil were taken along the right-of-way where the resistivity surveys indicated corrosive conditions, and the *p*H was determined by means of a potentiometer equipped with quinhydron calomel electrodes. Acid soils were submitted to the Corefield test. Hot asphalt paint and tight spiral wrapping were applied to all "hot spots." L. V. W. C.

622.698 : 620.197

1036. Soil-Corrosion Studies, 1934. Rates of Loss of Weight and Pitting of Ferrous Specimens. K. H. Logan. *Bur. Stand. J. Res.*, 1936, **16**, 431–466.—These soil corrosion studies were commenced in 1922 by the burying of six sets of ferrous pipe in 46 soils—one set to be removed every 2 years, so that the investigation would extend over 12 years.

However, the investigation has been extended from time to time, and the proceedings have been somewhat modified, so that instead of this being a final comprehensive report, it is, like previous ones, a progress report.

In 1934 the sixth and last set of original specimens was removed from 23 soils and examined. Tables give the rates of loss of weight in oz. per sq. ft. per year and the rates of penetration by pitting.

In general, the results of the examination of these specimens confirm earlier conclusions.

The average maximum penetrations for wrought iron, Bessemer and open-hearth specimens do not differ by more than a few per cent. The open-hearth iron and steel containing 0·2% Cu appear to pit rather more deeply than the other wrought samples. In some soils cast iron corrodes somewhat more rapidly than steel.

Soils differ so greatly in corrosiveness that average rates of corrosion or the average life of a pipe have little practical value.

A few bolts were included in the test, and a table gives average total losses for each set of bolts. Sherardizing or coating with lead materially adds to the life of bolts in all soils.

The effect of alloying iron was investigated and a specimen of tubing containing 26% Cr was tested, this having been buried in 1926. It was found that the rates of loss in weight were less for the alloy than for Bessemer steel in all soils, although the maximum pits were deeper in the alloy for two soils. In general, it can be said that the addition of chromium even in large proportions will not prevent serious pitting, especially in the case of soils containing chlorides.

Ni with or without Cr alloyed with iron tends to reduce the depth of the pits.

Certain materials seem to be especially suited or unsuited to certain types of soils. D. L. S.

622.698 : 620.197.5

1037. Junk Iron as a Source of Current for Cathodic Protection of Underground Structures. S. V. McGary. *Petr. Eng.*, July 1936, **7** (11), 70.—A description is given of an iron–copper cell in which the iron will corrode continuously, thus giving a current available for cathodic protection. The cell consists of a glass or wood container in the bottom of which is placed a copper plate covered by a concentrated $CuSO_4$ solution. Above this is a 1% solution of $CaCl_2$ containing 0·25% acetic acid, which is designed to prevent the protective scale forming on the iron plate terminal which is placed in it. The solutions are then covered with a film of oil to prevent oxidation of the iron. The cell is constructed so that the iron corroded is of sufficient quantity to precipitate the copper in the copper sulphate as recoverable metallic copper. A voltage of 0·65/0·70 is obtainable, this being twice that obtainable by the use of zinc metal attached to the lines. If the salvaged metallic copper is sold, the net cost of

the battery should be $1.54 per amp. year, and if converted to copper sulphate, it would be $0.71 per amp. year.

A battery of this type has been constructed using large casks and plates of 5 sq. ft., the casks holding enough chemicals for one year's operation. Each cell is capable of delivering on short circuit 1·8 amp. with an open voltage of 0·7, and under load delivered 0·9 amp. at 0·45 volt.

The advantages of the device are its cheapness of construction and operation, and its applicability to any location or size, but it has the disadvantage of requiring a very low ground resistance to produce a large amount of current, necessitating the use of large quantities of scrap surrounded by salt. C. L. G.

622.698 : 620.197.5

1038. Cathodic Protection of Pipe-Lines. D. B. Good. *Petr. Eng.*, July 1936, **7** (11), 57.—The variation in the resistance of ground beds used for the cathodic protection of pipe-lines, in different localities and at different seasons, endangers the complete protection of the pipe-line. For this reason readings of the voltage and current for several cathodic units were taken over an extended period (13–16 months). In one case a line in a marshy area in gumbo clay showed a rapid rise in resistance towards the end of a dry period, falling when rain occurred. The current density is probably too high for the ground-bed, so that peaks will probably occur oftener as the anode area becomes smaller. In a line laid in sandy soil the peaks were aggravated, owing to more rapid drying of the soil, although this could be reduced by watering. Rainfall was found to be the most important factor in these variations, but the variations in location, ground-bed design and general earth conditions also call for more complete study in order to ensure full protection of the line. C. L. G.

622.698(47)

1039. Petroleum Industry in the U.S.S.R. Pipe-lines. I. Ganitzki. *Mon. Petr. Roum.*, 1936, **37**, 855–857.—The first pipe-line in the Baku district was constructed in 1878 and was 9 km. long and 3 in. in diameter, whilst at the end of 1932 about 1200 km. of varied size line (3 in. to 12 in.) was handling crude oil. Approximately one-third of this was located in the Baku district, whilst the balance was in the Grosny and Maikop districts. A further 3147 km. of line have been laid down since 1906 (up to and including 1932) for carrying kerosine or crude oil to the marine terminals. Important lines are the Grosny Touapse 10-in. line 618 km. long, equipped with five pumping stations and handling 1·1 million tonnes a year, and the Baku–Batum 12-in. and 10-in. line, 842 km. long, handling 1·2 million tonnes of crude a year. More recent work includes the Caspii–Orsk line, 710 km. in length and 12 in. diameter. This line cost more than 109 million roubles, and handles one and a half million tonnes a year at present, which can be doubled by increasing the number of pumping stations.

The article describes in detail various other lines, and outlines the future plans for lines to be completed in 1938–42. Apparently it costs about two or three times the amount of money to instal a given length of pipe-line in Russia that it does in the U.S.A. W. E. J. B.

629.1 — 445.62

1040. New Methods for Reducing Vapour Losses in Truck Loading. Anon. *Nat. Petr. News*, 10.6.36, **28** (24), 65.—Four methods are in current use. Three are concerned with preventing splashing and churning during filling, and the fourth recovers the vapours produced during the operation. Splashing is prevented: (*a*) by filling through a fixed pipe extending to the bottom of the tank; (*b*) by filling through the emergency valve; (*c*) by filling in the usual way through the manhole, but with an extension fixed to the filler pipe, long enough to reach to the bottom of the tank. The fourth method uses a special filling device which when seated on the manhole with a rubber gasket delivers spirit through a 3-in. pipe and withdraws vapours through a 2½-in. pipe. The vapours are returned to the storage tank. By these methods losses are reduced by as much as 75%. The fire hazard is also greatly reduced. H. G.

Chemistry and Physics.

533.1

1041. Generalized High-Pressure Properties of Gases. K. M. Watson and R. L. Smith. *Nat. Petr. News*, 1.7.36, **28** (27), 29.—The article develops a number of equations and charts which represent an extension of the theorem of corresponding states into a consistent set of relationships. They are of use in approximating data relating to such properties of gases as compressibility factors, activity coefficients, enthalpy, heat capacities at high pressures, etc. It is pointed out that while the equations as developed are exact, the generalized results as presented are not entirely true, in so far as the basic theorem of corresponding states used in calculating them is not entirely true. Consequently the charts are recommended for use only in the absence of specific data. H. G.

547.2 : 662.61 : 542.943

1042. Influence of Pre-Heat Treatment on the Oxidation and Combustion of Hydrocarbons. R. Wellard. *Ann. des Comb. Liq.*, 1936, **11**, 275–343.—Following work on the speed of heating of inflammable gaseous mixtures, the author concludes that the rate of the external heat input governs the possibilities of spontaneous combustion. With unsaturated air-vapour mixtures there was a minimum value of the rate of heating below which no spontaneous combustion occurs, whilst with saturated mixtures, such as hexane vapour, above a certain rate of heat input no spontaneous combustion occurs. The author suggests that variation in the rate of external heating of an inflammable mixture allows a varying time for the formation of the unstable peroxides supposed to be essential to the formation of a true explosive wave. This corresponds to the phenomenon of "knocking," in which abnormal heating of the mixture causes peroxide formation, and as the spark appears, increases the speed of flame propagation to such an extent that a true detonation finally occurs.
C. W. W.

547.21

1043. Alkylation of Paraffins with Olefins in the Presence of Aluminium Chloride. V. N. Ipatieff, A. V. Grosse, H. Pines and V. I. Komarewsky. *J.A.C.S.*, 1936, **58**, 913–915.—Both normal and *iso*-paraffins can be alkylated in the presence of $AlCl_3$. Paraffins from butane to dodecane have been covered in the experiments which, on the olefin side, have used ethylene, propylene and butylenes. With $AlCl_3$ present, the main alkylation reaction is complicated by side reactions. The present paper is concerned mainly with the alkylation of: (1) hexane with ethylene at atmospheric pressure, (2) under pressure, (3) *iso*butane with ethylene, all in presence of aluminium chloride. In general, "auto-destructive alkylation" of the paraffin takes place, *i.e.*

$$\text{Paraffin} \longrightarrow \text{lower paraffin and olefin} \xrightarrow{+\ \text{original paraffin}} \text{higher paraffin.}$$

At the same time, intermediate paraffins are formed, *e.g.* pentanes, heptanes and nonanes from hexane and ethylene, whilst the olefin used polymerizes to yield paraffins. Lastly compound formation with aluminium chloride occurs which yields deep reddish-brown viscous addition compounds. The extent of each reaction is governed by the conditions of the experiment and the reactants. W. E. J. B.

547.313 : 547.53

1044. Olefine–Benzene Condensation with Sulphuric Acid Catalyst. H. L. Wunderly, F. J. Sowa and J. A. Nieuwland. *J.A.C.S.*, 1936, **58**, 1007–1009.—This paper describes the effects of boron fluoride as a promoter, the amount of sulphuric acid present, time and temperature on the olefine–benzene condensation. Working with propylene as the olefin, the presence of boron fluoride and sulphuric acid gave increased yields of mono- and di-*iso*propyl benzenes when the reaction was carried out at 4° C. for 2 hrs., as opposed to an experiment where sulphuric acid alone was used. An addition of BF_3 allowed the condensation of ethylene and benzene to occur under conditions such that sulphuric acid alone could not catalyse the reaction. A suggested reaction mechanism is outlined. W. E. J. B.

547.313 : 547.53

1045. Influence of Sulphuric Acid Concentration upon Reaction between Olefins and Benzene. V. N. Ipatieff, B. B. Corson, and H. Pines. *J.A.C.S.*, 1936, **58**, 919–922.—This paper describes the effect of sulphuric acid concentration on the reactions of propene and *iso*butene in the presence of benzene at temperatures of 0–60° C. In the presence of 96% sulphuric acid, propene reacts with benzene to yield mono-, di-, tri-, and tetra-*iso*propyl benzenes, whereas with 80% sulphuric acid half of the propene reacts as above, *i.e.* it alkylates the benzene, whilst the other half forms propyl sulphate, which can be converted, by hydrolysis, to *iso*propyl alcohol. With *iso*butene and 96% acid the main reaction is one of alkylation; with 80% acid, polymerization of the *iso*butene to tri*iso*butene occurs, whilst with 70% acid the reaction occurring is ester formation only, from which *tert.*-butyl alcohol may be obtained by hydrolysis. Further experiments have shown that, using sulphuric acid as catalyst, benzene may be alkylated by butene-1, pentene, octene, nonene and dodecene. Similarly, toluene and naphthalene were propylated with propene in the presence of 96% sulphuric acid. W. E. J. B.

547.514

1046. Kinetics of *cyclo*Pentadiene. G. B. Kistiakowsky and W. H. Mears. *J.A.C.S.*, 1936, **58**, 1060.—The authors are reporting briefly the results of experiments on the polymerization of *cyclo*pentadiene and the depolymerization of di*cyclo*pentadiene. In the gas phase the reactions were found to be second and first order, respectively. The polymerization reaction, in tetrahydronaphthalene as solvent, is of the second order. With pure liquid *cyclo*pentadiene the order decreases, becoming first order. As no chain mechanism is involved, the change of the reaction order is attributed to other causes, the full discussion of which is reserved for a later publication. W. E. J. B.

547.91 : 66.095.1

1047. Alkylation Accompanying Depolymerization. V. N. Ipatieff and H. Pines. *J.A.C.S.*, 1936, **58**, 1056.—When benzene was treated with di*iso*butene in the presence of 96% sulphuric acid at 0° C., *tert.*-butylbenzene, *p-di-tert.*-butylbenzene and hydrocarbons corresponding to tributylbenzenes were obtained. The same type of reaction occurred using aluminium chloride as the catalyst. The name "depolyalkylation" is suggested for reactions of this sort, where a depolymerization is followed by a subsequent alkylation.

The authors are studying the mechanism of the reaction. W. E. J. B.

547.91 : 66.095.1

1048. Destructive Alkylation with a Hydrogenating Catalyst. V. N. Ipatieff and V. I. Komarewsky. *J.A.C.S.*, 1936, **58**, 922–923.—In the dehydrogenation of *cyclo*hexane over various catalysts at 300° C. traces of diphenyl are always found. An experiment carried out at 350° C. in the presence of a mixed nickel oxide-alumina catalyst using *cyclo*hexane, resulted in the formation of hydrogen, methane, benzene and toluene. Thus the latter product indicates that destructive alkylation occurred. Similarly ethyl *cyclo*hexane yielded benzene, toluene, methane and hydrogen. The suggestion is made that the alkylating action of the catalyst is due to the alumina, as follows :—

$$Al_2O_3 + H_2O \longrightarrow 2AlO(OH)$$
$$AlO(OH) + C_2H_4 \longrightarrow AlO(OC_2H_5).$$
$$AlO(OC_2H_5) + C_6H_6 \longrightarrow C_6H_5\,C_2H_5 + AlO(OH).$$

That is, an intermediate ester formation is proposed. W. E. J. B.

547.91 : 66.095.1

1049. Phosphoric Acid as a Catalyst for the Destructive Alkylation of Hydrocarbons. V. N. Ipatieff, V. I. Komarewsky and H. Pines. *J.A.C.S.*, 1936, **58**, 918–919.—This paper deals with the destructive alkylation of 2 : 2 : 4-trimethylpentane and benzene and *n*-hexane and benzene in the presence of phosphoric acid as catalyst. The reactions take place as follows :—

$$\textit{iso}\text{-Octane} + \text{benzene} \xrightarrow{H_3PO_4} \textit{iso}\text{butane} + \textit{tert.}\text{-butylbenzene.}$$

$$2\text{ mols. } n\text{-hexane} + 2\text{ mols. benzene} \longrightarrow \text{propane} + \text{ethane} + \textit{iso}\text{propyl benzene} + \text{butylbenzene.}$$

In the absence of phosphoric acid, these reactions do not occur under the experimental conditions, for which the original should be consulted. W. E. J. B.

665.511 : 66.091

1050. Isolation and Identification of Acenaphthylene and Pyrene from Products of Pyrolysis of Natural Gas. A. W. Campbell, N. H. Cromwell and J. J. Hager. *J.A.C.S.*, 1936, **58**, 1051–1052.—The authors have investigated a waxy material which separates from the hydrogen stream, when the exit gas from the Thermatomic process is cooled. Acenaphthylene, pyrene and polymers of the former were isolated. The polymers differed in molecular weight from those already described in the literature.
W. E. J. B.

Analysis and Testing.

532.13

1051. Nomenclature of Rheology. S. Erk. *Oel und Kohle*, 1936, **12**, 642–645.—Equivalent French, German, and English terms are given for the most important ideas and phenomena occurring in the literature of rheology. It is clear that the "flow" of non-Newtonian fluids and of plastic materials cannot be represented by a single physical expression.
The flow curves of various types of materials are discussed. P. G. H.

532.13

1052. Measurement of Oil Viscosity by Modified Ostwold Pipettes. F. L. Cornaham. *Petr. Times*, 1936, **35**, 729.—A modified Ostwold pipette has been designed in order to produce an instrument capable of determining viscosities with a maximum error of 0·2%. The design is described in detail. Apart from considerations of bulb and capillary end shapes which have been designed to minimize drainage and kinetic energy corrections, the chief modification is in the disposition of the two bulbs. These are arranged, by suitably bending the tubes connecting them, so that their centres lie in the same vertical line. In this way the error involved by the change of head due to tilting the instrument is minimized. Three pipettes have been designed to cover the viscosity range of 4·6–1250 centistokes. It is claimed that these pipettes in routine use produce results with a maximum error of 0·3%, provided the minimum efflux time is 200 seconds, that the timing device is correct to $\pm$ 0·2 second and that the temperature of the viscometer bath is controlled to $\pm$ 0·05° F. H. G.

532.13

1053. Viscosimetrical Inspection of Lubricating Oil in Service. L. Steiner. *Engineering*, 1936, **141**, 659–660.—A brief description is given of the essential features of the Steiner Viscometer, together with a diagram, graphs and descriptions illustrating its application. J. L. T.

535.371

1054. Quantitative Measurement of Fluorescence in Mineral Oils. F. Evers. *Oel und Kohle*, 1936, **12**, 457–458. (See Abstract No. 1299 (1935).)—A cadmium sulphide plaque was found to afford a better standard than "Uran" glass, since its fluorescence intensity response curve was comparable with that of mineral oils themselves.
P. G. H.

621.892 : 543.86

1055. Solution of Asphaltic Deposits. A. Maillard. *Ann. des Comb. Liq.*, 1936, **11**, 151–152.—A short description, illustrated by a diagram, of an apparatus using a glass Gooch crucible, for dissolving in chloroform under pressure, asphalt in deposits from used oils. J. L. T.

681.121

1056. Fuel Meter for Oil-Engine Trials. Anon. *Engineering*, 1936, **142**, 23.—Difficulties encountered with the use of the usual type of glass gauge at the side of fuel tanks are discussed. The apparatus mentioned determines the fuel consumption on a weight basis. Inside a fixed tank, an auxiliary tank is suspended from a knife-edge and one end of a lever arm. The weight of this auxiliary tank and its contained fuel is partly counter-balanced by means of a weight. Changes of level of the lever arm are shown by a sensitive indicator, and are easily adjusted; changes of weight due to fuel consumption are shown by a spring balance. As the engine consumes fuel from the fixed tank, a carburettor allows fuel to flow from the auxiliary tank into the fixed tank. A three-way cock is provided at the side of the latter to enable weighed quantities to be withdrawn if desired, so that checks can be made of the consumption as indicated by the balance.

A photograph and diagram are given. W. A. W.

532.73 : 608.3

1057. Patents on Analysis. J. Y. Johnson. E.P. 448,638, 12.6.36. Improvements described in an apparatus for the separation of liquids of different specific gravity which have been mixed with each other. W. S. E. C.

Refining and Refinery Plant.

547.724

1058. The Furans. F. N. Peters, Jr. *Ind. Eng. Chem.*, 1936, **28**, 755.—A *résumé* is given of the industrial uses of compounds of the furane group, of which furfural is the most important. Furfural is successfully used in the manufacture of aldehyde-phenol resins possessing good moulding properties. Furfural is a good solvent for gums, resins and potentially reactive phenol resins. Solutions of the latter in furfural are pre-eminently used in the manufacture of resin-bonded abrasive wheels. As a refining agent, furfural was introduced industrially in 1927 for the manufacture of pale rosins by solvent extraction of dark-coloured pine-wood rosins in gasoline solution. In 1933 the first furfural lubricating-oil refining plant was commissioned, and since then its highly selective solvent action has resulted in the erection of several more plants. A number of less important uses of furfural and other furanes are cited.

J. W. H.

615.9 : 66.062

1059. Health Risks in Industry. Anon. *Chem. Trade J.*, 1936, **99**, 85.—The annual report for 1935 of the Chief Inspector of Factories contains a chapter by Dr. J. C. Bridge, the Senior Medical Inspector of Factories, who concludes that the increased activity in industry has not adversely affected the general health of workers. Items of interest to the petroleum industry include :—

Toxicity of Solvents. The variety and loose nomenclature of the solvents used renders their control difficult. Although the results of tests on animals must be taken with some reserve as indicating the effects on man, the conditions of use of solvents must limit the inhalation of its vapour until it has been proved to be non-toxic. Where a vapour is known to be toxic, the best solution is the use of a non-toxic solvent.

Epitheliomatous Ulceration. The distribution of cases of epitheliomatous ulceration in relation to the causative agent and industry is given in a table for the years 1931–35, emphasis being laid on the value of periodical medical inspection.

Sulphur Gases. Cases of gassing from the inhalation of SO_2 and H_2S were recorded, reference being made to the characteristic smell of the latter not being perceptible when it is present in dangerous concentrations.

Chlorinated Solvent Vapours. Seven cases, including one death, of poisoning by trichloroethylene vapours in metal degreasing plants were recorded. Six further cases occurred during the cleaning of oil tanks with this solvent. A case also was recorded of poisoning by undue exposure to carbon tetrachloride vapours.

C. L. G.

66.061.4

1060. Extraction of Solids with Liquids. E. A. Ravenscroft. *Ind. Eng. Chem.*, 1936, **28**, 851.—Graphical solutions are given of problems involving multiple, continuous counter-current and batch counter-current extraction of solids with liquids, including the case of extraction with varying entrainment. J. W. H.

66.067.72 : 661.183.44

1061. Activity of Certain Decolorizing Media. E. Erdheim. *Ole, Fette, Wachse*, 1936 (9), 4–6.—The decolorizing power of 21 materials (natural earths, activated earths and activated carbons), when applied to oil/benzine solutions of different initial colour depth, was determined quantitatively. After a standard treatment the decolorizing effect was expressed as a percentage of the original depth of colour and, except when Floridin XXF and Frankonit H were used, was found to decrease as the initial colour was deeper. P. G. H.

665.511 : 665.521.2

1062. Gasoline Plant Efficiency Improved. J. C. Albright. *Petr. Eng.*, July 1936, 7 (11), 27.—The efficiency of operation of a natural gasoline plant at Carter Nine (Okla.) has been improved by several minor changes. Cylinder-jacket cooling has been changed from a forced feed semi-closed system to a gravity system, the water being cooled by two steel tanks with louvre towers. Condensate and low-pressure steam are blended with make-up feed-water for the boilers, in a vertical column fitted with low and high water indicators. Only a slight volume of steam is lost to the air, and, being enclosed, the water is prevented from becoming saturated with oxygen, thereby reducing corrosion. The electrical generating system which supplies the plant and field pumps is being remodelled so that some of it can be shut down during light load periods. Better cooling is now effected by providing separate systems for the gas and mineral seal oil. The louvre tower has been placed so that the prevailing winds blow through the unit from one side rather than down the length, giving a greater cooling effect. The crankcase oil from the engines is now reclaimed by steaming, removal of free carbon and decolorization. The addition of extra field lines has improved the even withdrawal of gas. Freezing of lines in winter is reduced by the installation of denatured alcohol lubricators. Ordinarily bleaching powder is now used for treating the gasoline in place of the sodium hypochlorite (either manufactured or purchased) previously used. C. L. G.

665.521.2/665.521.3 : 66.067.74

1063. Inhibitors and Neutralizers Keep Light Oil Colourless. J. B. Rather and L. C. Beard. *Nat. Petr. News*, 13.5.36, **28** (20), 34.—The discoloration of refined kerosine and gasoline in storage is due to oxidation, and may be effectively inhibited by the use of organic reducing agents. Bodies which have been used are: thiocarbanilide, hydroquinone, resorcinol, pyrocatechin, pyrogallol, phloroglucinol, 1 : 2 : 4-trihydroxybenzene, butyl pyrogallol, alkyl-substituted polyhydroxybenzenes, ethanolamines, urea and thiourea. Many of the compounds possess the added property of decolorizing discoloured material. The usual procedure in treating off-colour oil is to agitate with a solution of the reagent in ethyl alcohol at the rate of 1 lb. reagent to 2000–15,000 gallons of oil, according to the initial colour of the oil and the final colour desired. All distillates, even from the same source, do not show the same degree of colour instability, and the most economical method of treatment is to refine to a definite standard and to decolorize such material as may need treatment after storage and before final distribution. H. G.

665.54

1064. Nickel and its Alloys in Petroleum Refining. D. R. W. Müller. *Petr. Zeit.*, 15.7.36, **32** (29), 3.—The applications of nickel and its alloys in the construction of refinery plant and accessories, are detailed and divided into six main classes. These classes consist of: (1) Monel metal, (2) alloys of copper with less than 50% of nickel, (3) Inconel and nickel-plated steel, (4) special steels containing low and high contents

of nickel respectively, (5) special cast irons with a low content of nickel, and (6) special cast irons, *e.g.* austenitic iron.

The nickel content and the Brinell hardness values of the alloys are given and the chief applications are enumerated. These are summarized in the following:

Monel metal is used in the construction of piston rods for pumps, distillation apparatus, inlet valves for use in alkali or acid treatment and for the manufacture of orifices for oil burners.

Class 2 consists of alloys containing 30% of nickel and 70% of copper, which are claimed to be superior to bronze for use at high temperatures. They are used in the construction of condensers and heating apparatus.

Inconel of class 3, is a Ni–Cr alloy containing 14% of chromium, and is more resistant than Monel metal to corrosion and the effect of sulphur compounds. It is used in the construction of column-casings, distillation apparatus and of cylinders for transport purposes.

Special steels containing only low quantities of nickel, viz. 1–1·5% Ni, 0·45% Cr and 0·24–0·35% of carbon have relatively few uses. They are applied in the construction of valves for working temperatures below 480° C. and up to 95 atm. pressure. These steels of high nickel content are highly-resistant to oxidation and to the corrosive action of sulphur compounds at high temperatures. They contain 20% Ni, 8% Cr, 1% Si, and small quantities of wolfram, molybdenum and aluminium. They are used in the construction of retorts for cracking. When a stability at higher temperatures is required, an alloy containing 24% Cr and 12% Ni or 25% Cr and 20% Ni is found to be most suitable.

Class 5 comprises special cast irons for use at working temperatures above 535° C., *e.g.* coils, ammonia pumps, coolers and condensers. The nickel content varies from 2 to 5%. Nickel-tensyl-iron, which is used extensively in America, contains 2% Ni.

Class 6 consists of alloys containing 3–6% Ni, 0·5–2·5% Cr, and austenitic iron containing 14% Ni, 6% Cu and 1·5% or more of Cr. The latter is highly resistant at temperatures of 815° C.

W. S. E. C.

665.547.746 : 608.3

1065. Patents on Refinery Plant. F. A. F. Crawford, W. A. P. Challener and I.C.I., Ltd. E.P. 435,615, 19.9.35.—Fractionator for the separation of liquid nitric esters from waste acids resulting from their manufacture or from washing liquids used in their purification.

66.097 : 608.3

Houdry Process Corpn. and T. B. Prickett. E.P. 449,671, 1.7.36.—Improved converter for use in controlling catalytic reactions.

665.54 : 620.197 : 608.3

Soc. D'Exploitation des Cables Electriques Systeme Berthoud Borel et Cie. and J. Borel. E.P. 447,064, 11.5.36. A process is described for the protection of metals against electrolytic corrosion.

66.048.3 : 608.3

A. J. V. Underwood. E.P. 448,556, 10.6.36. Fractional distillation apparatus for multi-stage operations.

665.54 : 662.9 : 608.3

L. de Florez. U.S.P. 2,043,095, 2.6.36. Improved furnace for heating hydrocarbon fluids.

W. S. E. C.

Cracking.

66.092.123.6 : 608.3

1066. Patents on Cracking. F. W. Sullivan, Jr., and R. F. Ruthruff. U.S.P. 2,043,269, 9.6.36. Cracking of hydrocarbon oil in three cracking zones in which the products from one cracking zone are passed to the next zone without recycling.

66.092.88 : 668.3

J. K. Roberts. U.S.P. 2,044,636, 16.6.36. Cracking of hydrocarbon oils to increase the yield of gasoline and decrease carbon formation. The oil is lightly cracked, and this cracked oil is used as a flushing medium to prevent coke deposition in the lower portion of the vapour-phase soaking chambers.

66.092.14 : 668.3

E. W. Zublin. U.S.P. 2,045,114, 23.6.36. Cracking operation using several expander chambers in the vapour phase.

66.092.122.2 : 668.3

W. W. Gary and J. T. Ward. U.S.P. 2,045,458, 23.6.36. Pyrolytic conversion of hydrocarbon oils by means of mild cracking ("viscosity breaking") under pressure in order to obtain, as well as gasoline, fuel oil of desired viscosity and low pour point.

66.092.5 : 668.3

M. Pier, F. Ringer and W. Simon. U.S.P. 2,045,794–2,045,795, 30.6.36. Destructive hydrogenation and cracking of middle oils consisting mainly of hydrocarbons practically saturated with hydrogen. The oils are first cracked at 500–800° C. and under at least 50 atm. pressure, and then the products are hydrogenated at 300–500° C. The benzene hydrocarbons formed are then dehydrogenated at 500–750° C. in the presence of oxides of molybdenum or zinc as catalysts. W. S. E. C.

Hydrogenation.

66.094.173 : 668.3

1067. Patents on Hydrogenation. H. P. Stephenson. E.P. 449,603, 30.6.36. Preparation of catalysts for hydrogenation, ammonia and methanol synthesis processes. The catalytic substance or proto-catalyst is incorporated in a coal–oil mixture and then carbonized to yield a semi-coke or coke. The catalyst so obtained is in a very fine form and evenly distributed over a very large surface. W. S. E. C.

Polymerization.

547.313.2 : 542.952.6

1068. Polymerization of Ethylene with Aluminium Chloride. V. N. Ipatieff and A. V. Grosse. *J.A.C.S.*, 1936, **58**, 915–917.—The polymerization at room temperature of ethylene under 20 atm. pressure in the presence of $AlCl_3$ was investigated using a glass-lined autoclave.

It transpired that pure aluminium chloride did not react with pure ethylene under these conditions, and that traces of hydrogen chloride or moisture were necessary to cause reaction. The product from a reaction, with HCl present and using aluminium chloride of normal purity, consisted of two layers. The upper layer was water-white and consisted of paraffins, whilst the lower layer was dark reddish-brown in colour and consisted of addition compounds of $AlCl_3$ with unsaturated cyclic hydrocarbons. The latter resemble terpenes. At most, 10 moles. of ethylene were condensed by 1 mole. of $AlCl_3$.

It is suggested that the reaction mechanism is as follows: True polymerization to mono-olefins occurs, which are transformed by cyclic or intra-molecular alkylation into naphthenes. The latter are converted to a mixture of paraffins and unsaturated naphthenes which combine with the aluminium chloride to give the lower-coloured layer. This type of polymerization is termed by the authors "conjunct polymerization." Some of the paraffins are formed by further reaction between ethylene and paraffins. The hydrogen chloride is important, as without it the reaction is impossible. The suggested reaction mechanism is:

$$C_2H_4 + HCl \xrightarrow{AlCl_3} C_2H_5Cl + C_2H_4 \xrightarrow{AlCl_3} C_4H_9 + HCl.$$

Thus the hydrogen chloride is regenerated continuously. W. E. J. B.

665.511 : 66.095.26

1069. New Method of Benzine Production by the Polymerization of Gases. R. Fussteig. *Petr. Zeit.*, 15.7.36, **32** (29), 6.—Catalytic and thermal processes are detailed, the latter involving the application of temperature and pressure. During catalytic polymerization, only saturated hydrocarbons are polymerized, whereas in thermal processes mixed hydrocarbons, *e.g.* methane, ethane, ethylene, propylene, etc., undergo polymerization, causing a saturation of free valencies by means of other unsaturated hydrocarbons. The bond C=C has a free affinity and tends to form two molecules.

Natural gas is suitable for direct polymerization, but must first be cracked, preferably in the vapour phase, to convert the saturated into unsaturated hydrocarbons. A comparison of the composition of the gases produced by vapour phase (gyro-system) and liquid phase (Dubbs) shows that the former process is preferable—the yield of unsaturated hydrocarbons amounting to 46·5%.

Polymerization is then effected by two methods: (1) polymerization of gaseous constituents under high pressures at relatively low temperatures; (2) polymerization of liquid constituents under high pressures at low temperatures. The temperature used is 430° C. in order to give a maximum yield of aromatic hydrocarbons.

In the process, cracked gas is first compressed under 42–58 atm. pressure and passed to a tube heater (480–540° C.), thence to a reactor. Since the reaction is exothermic, the free heat is absorbed artificially—cold gas or oil being sprayed into the reaction system in order to maintain the reaction at the desired temperature.

The polymerized gas is passed to a tower, where the tar compounds formed from ethylene are separated and continuously withdrawn. The vapours from the top of the tower are conveyed to a fractionating tower, where the incondensable gases are separated from the liquid benzine. The latter is led from the bottom of the tower to a pre-heater before passing to the cooler. The incondensable gases are conveyed to a gas-holder from which they are recirculated with the initial gas and subjected to polymerization. Only 20% of the initial gas is polymerized. This yield is increased by separating the low-molecular saturated hydrocarbons C_1, C_2, by an absorption process when the high-molecular hydrocarbons are absorbed, and then returned in the liquid form under high pressure.

The conditions for the separation of low-molecular gaseous hydrocarbons are 700° C. and 5 atm. pressure when no tar forms. Polymerization of high-molecular gaseous hydrocarbons is effected at 480–520° C. and 42–58 atm. pressure.

When excessive quantities of methane and other saturated hydrocarbons are present in natural gas, it must first be subjected to catalytic pyrolysis and then subsequently polymerized.

In essence, the process of converting natural or cracked gases into motor fuels consists of: (1) polymerization at high temperatures and low pressures of propylene and butylene; (2) pyrolysis of unattacked gases; (3) polymerization at high temperatures and low pressures of cracked gas from (2). W. S. E. C.

665.521.23 : 668.3

1070. Patents on Polymerization. J. Y. Johnson. E.P. 448,690, 18.6.36. Production of anti-knock motor spirit by treating a mixture of hydrogen and carbon monoxide at elevated temperatures and pressures and dehydrating the alcohol products formed after removal of methyl alcohol, to form *iso*-olefines. The lower-boiling portions of the latter are polymerized and part of the polymerized portion added to the heavier portion.

66.095.26 : 668.3

J. H. Boyd, Jr. U.S.P. 2,042,452, 2.6.36. Polymerization of unsaturated hydrocarbons containing 2–5 carbon atoms to form motor spirit by cracking first at 950° F. and 750 lb. pressure/sq. in. and then at 0·900° F. and then polymerizing the products. W. S. E. C.

Crude Oil.

665.51 : 665.542.2

1071. Continuous Acid Treating of Crude Oils for the Production of Motor Oils and Bright Stocks. G. M. Woods. *Petr. Eng.*, July 1936, **7** (4), 38.—A laboratory com-

parison has been made of a continuous method of acid-treating crude with the usual batch treatment of finished lubricants. A typical Mid-Continent paraffin-base crude (M.C.) and a highly asphaltic paraffin-base crude from the Texas Panhandle (T.P.) area were selected, the former as being capable of yielding bright stock, whereas the latter does not. The continuous crude oil treatment given consisted of 5 lb. of 98% acid per brl. for M.C. crude and 10 lb. for the T.P. crude, followed by settling, water-washing and neutralization with caustic. The crudes were then distilled, finishing off under vacuum and the blended lubricating oil cuts fluxed with butyl acetate, chilled to − 10° F., filtered and distilled, finishing off with contact treatment with Filtrol clay. The batch treatment of the oils obtained by distillation from the two crudes was carried out on the oils dewaxed and filtered by the same method, the T.P. residual stock not being examined owing to the asphalt present, although it could be propane treated.

M.C. crude gave yields of 4·69% of motor oil and 8·33% of bright stock by the crude oil treatment, as compared with 4·45% and 6·29% by the batch treatment of the finished oils. T.P. crude gave 6·10% and 12·74% of motor oil and bright stock by the former method and 6·55% of motor oil by the latter method. Savings in acid and clay usage were obtained, the main advantage being the possibility of obtaining bright stocks from asphalt-containing crudes. Also the continuous acid treaters originally installed for cracked gasoline treatment, and no longer required (owing to the use of dyes and inhibitors) would be available for such treatment. C. L. G.

665.521 : 665.54

1072. Refining of Sam Fordyce Crude (S.W. Texas). J. L. Sewell. *Petr. Eng.*, July 1936, **7** (11), 20.—A refinery at Port Isabel (Texas) has been in operation since December 1935, processing 21·5° A.P.I. crude delivered by pipe-line from the Sam Fordyce field (S.W. Texas). The plant has a capacity of 6000 brl. per day, producing by topping and cracking, fuel oil, two grades of furnace oil and gasoline. The crude contains practically no gasoline, but distils 85% to 691° F. (366° C.), yielding a distillate of gravity 25·0° and a viscosity of 46 secs. S.F./100° F., the bottoms having a gravity of 9·4°, a pour-point of 65° F. and a viscosity of 890 secs. S.F./122° F.

The heated crude is flashed into a bubble tower, where 30% of distillate (27·5° A.P.I.), which is marketed as No. 2 furnace oil, and 3% of 400° F. E.P.T. naphtha of gravity 43° A.P.I. are taken off. The reduced crude is then cracked, taking off 62% of pressure distillate, leaving a 5–6° A.P.I. cracked residue with a viscosity of 150 secs. SF/122° F. The pressure distillate is fractionated into gasoline and cracked furnace oil distillate, which after treatment is blended with straight-run No. 2 furnace oil. The gasoline is sweetened in the vapour phase with lead sulphide and clay and then stabilized. The pressure distillate bottoms are marketed as No. 4 furnace oil.

Plant yields are: S.R. gasoline 2·8%, S.R. No. 2 furnace oil 30·0%, cr. gasoline 10·0%, cr. No. 2 furnace oil 13·2%, cr. No. 4 furnace oil 15·0%, cr. fuel oil 25·0%, loss 4·0%. A flowsheet, photographs and details of auxiliary equipment and storage and loading facilities are given. C. L. G.

665.51 : 665.542 : 608.3

1073. Patents on Crude Oil. A. E. Pew, Jr. U.S.P. 2,045,492, 23.6.36. Apparatus for chemically treating topped crude oil preparatory to distillation of lubricating oil. W. S. E. C.

Motor Fuels.

662.753.12 : 536.423

1074. 12% Gained in Acceleration by using more Volatile Fuels. G. G. Brown. *Nat. Petr. News*, 13.5.36, **28** (20), 41.—A comprehensive investigation into the relation between the volatility of a fuel and engine performance is reviewed. It is shown that a decrease of 5° F. in the 50% end point in the A.S.T.M. distillation would allow for equal throttle response with a drop in intake temperature of 3° F. This leads to an increase in power output equivalent to that produced by the increase in compression ratio permitted by an increase of 1 octane number in the fuel. If the volatility index be defined as 285 minus the 50% E.P. temperature in degrees F., then an increase

of 4–5 in the volatility index leads to a potential increase in power output, at constant speed, equivalent to an increase of 1 octane number. In order to obtain this increase in power it is, naturally, essential to make the necessary adjustments in order to reduce intake temperatures. H. G.

662.753.12 : 536.423

1075. **Volatility Index.** W. W. Scheumann. *Nat. Petr. News*, 20.5.36, **28** (21), 37.—The article discusses the value of a simple volatility index from the salesman's point of view. At present the results of the A.S.T.M. distillation test and vapour-pressure test can be translated in terms of engine performance but they are too complicated to appeal to the public. The volatility indexes at present in use are unsatisfactory for one or another reason it is stated. Some are derived from considerations of two points on the distillation curve and it is desirable that a single observation should suffice. Again there is a need to consider volatility in relation to seasonal temperatures which leads to a variation in the relative value of a particular index at different times of the year. It is urged that a volatility index be introduced whose value is independent of air temperature and which has a simple and direct relation to performance. H. G.

662.753.21

1076. **Examination of "Still-Benzole."** Lichti. *Oel und Kohle*, 1936, **12**, 459–461.—In order to increase the yield of light hydrocarbons by the high temperature carbonization of coal, tar-vapours and gas are sucked off from the inner region of the carbonizing mass. The liquid obtained therefrom, after removal of naphthalene, phenols and bases, was found to contain 71·8% aromatics (benzole 41%; toluene 12·3%; xylene 5·9%), 10–12% "Benzine" hydrocarbons, and 15% unsaturateds. P. G. H.

662.758.2

1077. **Effect of Methyl Alcohol on Blends of Ethyl Alcohol and Benzine.** K. R. Dietrich and W. Lohrengel. *Oel und Kohle*, 1936, **12**, 455–457.—Methyl alcohol is miscible with benzine only when ethyl alcohol or benzole is present, the mixtures being very sensitive to the presence of water. The "water-values," measured experimentally as c.c. of water necessary to cause heterogeneity in 100 c.c. of the blend, decrease as the temperature falls. To allow for possible contamination by water the minimum proportion of ethyl alcohol and/or benzole required for complete miscibility must be considerably exceeded in practice. In fuels containing 10% total alcohol the use of methyl with ethyl alcohol in the proportion 2 : 8 instead of 1 : 9 increases sensitivity to water. Stability to low temperature and to water is improved by increasing *total* alcohol content to 11%. Experimental curves illustrate "water-values" of 8 benzines containing varying proportions of ethyl and methyl alcohols. P. G. H.

662.758.2

1078. **Methanol for Use in Motor Fuels.** T. Hammerich. *Oel und Kohle*, 1936, **12**, 641.—The water-sensitivity of fuels containing MeOH is much influenced by the degree of purity of the alcohol. Excessive water content may be detected as follows:—100 c.c. (at 20° C.) of the MeOH are mixed with 100 c.c. of a mixture of *n*-heptane (I.G.) and thiophene-free benzene (80%/20% by volume). The liquid is clarified if necessary by warming and the initial clouding temperature on cooling is determined to the nearest 0·01° C. Water-contents of 0·00%, 0·05%, 0·10% and 0·15% (vol.) correspond to clouding temperatures 21·6°, 22·59°, 23·56° and 24·54° C. respectively. The addition of 1% (vol.) *iso*butyl alcohol to the MeOH depresses the clouding point by about 1·9° C. for water-contents of the above order. P. G. H.

665.58(52)

1079. **Synthetic Fuels in Japan.** Anon. *Chem. Trade J.*, 31.7.36, **99**, 85.—The Chosen Coal Industry Co. is erecting a coal hydrogenation plant at a cost of 10 million yen. The plant will be ready in June, 1937 and will produce, by a process developed by the company, 50,000 tons of oils, which amount it is planned to triple later. From 4 tons

of coal, 1 ton of oil (motor spirit and heavier) will be produced, half the coal being used as fuel in the process.

A subsidiary of Mitsui proposes to erect a factory at Hokkaido for the production of motor fuel by the Fischer process. C. L. G.

662.758 + 621.43 — 722.6 : 668.3

1080. Patents on Motor Fuel. R. G. Terakopoff. E.P. 448,446, 8.6.36. Fuel for use in internal combustion engines consisting of paraldehyde and tetrahydronaphthalene in the absence of ether; 50% of an oleaginous material is added as an upper cylinder lubricant.

665.521.2 : 665.542 : 668.3

Bataafsche Petroleum Mij., H. P. A. Groll and G. Hearne. E.P. 449,783, 3.7.36. Refining of light hydrocarbons containing mercaptans. The initial material is oxidized by means of air or an oxygen-containing gas at 80–150° C. and at superatmospheric pressure in the presence of a catalyst, *e.g.* Cu, Pb, Fe, Cr, Ni, Mn, Ag or Pt. The treated mixture is withdrawn and fractionally distilled to separate disulphides formed.

665.531.2 : 665.541 : 668.3

H. V. Atwell. U.S.P. 2,042,448, 2.6.36. Refining of cracked distillates by heating them above the vaporizing temperature but below cracking temperature under 200 lb. pressure/sq. in. for a sufficient time to effect polymerization of gummy constituents.

665.531.2 : 665.542 : 668.3

A. Lachman. U.S.P. 2,042,718, 2.6.36. Refining of cracked spirit by passing the vapour together with air through an aqueous solution of a zinc salt (other than the iodide) admixed with zinc oxide.

665.531.2 : 665.542 : 668.3

W. M. Stratford. U.S.P. 2,043,016, 2.6.36. Refining of cracked spirit containing unsaturated compounds by means of a solid absorbent material to effect polymerization of the unsaturated hydrocarbons.

665.521.2 : 665.542 : 668.3

W. M. Malisoff. U.S.P. 2,043,254, 9.6.36. Refining of straight-run or cracked spirit by washing with an alcoholic solution of caustic soda containing less than 15% of water, separating the washed oil from the solution and treating the separated oil with sulphuric acid.

665.521.2 : 665.543.061.5 : 668.3

O. F. Simons. U.S.P. 2,043,288, 9.6.36. Solvent fractionation of motor fuel stock, *e.g.* cracked distillates. The stock is distilled to give two distillate fractions of boiling range 200–300° F. and 400–500° F. respectively. The latter is selectively extracted with a solvent mixture of sulphur dioxide and methanol to yield a raffinate and extract phase, SO_2 and most of the methanol are removed from the extract phase, and the remainder of the extract phase is blended with the 200–300° C. fraction.

665.521.2 : 665.542.2 : 668.3

Le Roy G. Story. U.S.P. 2,043,936, 9.6.36. Refining of motor spirit with sulphuric acid at temperatures not above 200° F. and under 300–3000 lb. pressure/sq. in. in a plurality of counter-current stages.

665.531.2 : 665.545.53 : 668.3

D. R. Stevens and C. R. Payne. U.S.P. 2,044,739, 16.6.36. Degumming and stablizing cracked distillates by adding a small proportion of residual oil from the distillation of a distillate which has been subjected to heat and pressure to degum it, heating the mixture to 700–800° F. and under 1000 lb. pressure for 15–30 mins. A degummed and stabilized gasoline is recovered from the reaction products.

665.521.2 : 665.542 : 608.3

W. A. Schulze. U.S.P. 2,045,057, 23.6.36. Removal of carbon bisulphide from petroleum distillates by adding morpholine, removing the precipitate formed and water-washing the oil to remove excess of morpholine and the last traces of CS_2-morpholine reaction compounds.

665.531.2 : 665.542.2 : 608.3

J. C. Morrell. U.S.P. 2,045,234, 23.6.36. Refining of cracked distillates by treatment with sulphuric acid, chromic acid and a salt of these acids.

665.531.2 : 665.542 : 608.3

S. Comay. U.S.P. 2,045,262, 23.6.36. Refining of cracked distillates by heating them with nitrates of iron, copper, aluminium, bismuth, etc., to remove sulphur compounds.

665.531.2 : 665.543.061.5 : 60.062.182 : 608.3

S. E. Campbell. U.S.P. 2,045,696. Refining of cracked spirit by treatment first with liquid sulphur dioxide, then treating the extract with dilute sulphuric acid. The acid-free distillate is then treated with caustic soda to absorb organic acid impurities and then with concentrated sulphuric acid at low temperatures. The extract is neutralized and mixed with the SO_2 extract. W. S. E. C.

Kerosine.

665.521.3 : 622.412

1081. Detection and Measurement of Firedamp. Mines Dept. Safety Pamphlet No. 4B. (Rev. 1936).—A description is given of the use of a flame safety lamp burning coke or kerosine, for the detection and estimation of methane in mine atmospheres.

The wick of the lamp is turned down until the flame is not more than ½ in. high, giving a faint blue line with a speck of yellow in the middle (known as the fuel cap). This is more readily seen with spirit than with oil lamps. When firedamp is present another cap (known as the gas cap) similar in appearance to the fuel cap is seen above it, its size being in proportion to the amount of methane in the air.

Photographs are given indicating the size of the gas cap for atmospheres containing up to 4·0% methane, 1·0% being the minimum amount distinguishable from the appearance of the flame.

The precautions to be adopted when using the lamp are outlined. C. L. G.

Lubricants and Lubrication.

621.89

1082. Engine Carbon. O. A. Livingstone and W. A. Gruse. *Nat. Petr. News*, 24.6.36, 28 (26), 24 F.—It is contended that engine design has advanced to the point where the maximum advantage is taken of the properties of the fuel and lubricants available, and that further advance is dependent on the reduction in the carbon-forming tendencies of those materials. This is in part due to the fact that operating conditions are now often very close to the safety limit, and the importance of carbon deposits is therefore magnified. Fuel and lubricating oil are reviewed from the point of view of their tendencies to produce carbon. It is shown that the fuels available, when used under normally good conditions, are an almost negligible factor in carbon formation. In other words, if the fuel does produce an appreciable carbon deposit it is because of mal-adjustment or unfavourable conditions. In analysing the conditions tending to promote carbon deposition by the lubricating oil, it is concluded that the oxidation and/or burning of the oil film in the combustion chamber is the principal factor. However, the magnitude of this tendency is increased by a degree dependent on the extent to which oxidation of the oil in the crankcase and on the cylinder wall produces bodies with a high carbon-forming potentiality. It is considered that the magnitude of the deposit produced by a particular oil will depend on : (*a*) The amount of oil not volatile at the cylinder head temperature ; (*b*) the amount of coke produced from this residue ; (*c*) the degree of adherence of this coke to the head. In this connection it is

suggested that no single "coking test" gives information relative to all three of these factors. The first two are functions largely of the refining of the oil, whilst the latter is dependent chiefly on the chemical composition of the oil. H. G.

621.892.27

1083. Colloidal Graphite in Oil. Anon. *Petr. Times*, 1936, **35**, 732.—Graphite owes its lubricating properties to its laminated structure and the ability of these lamine to shear under stress, and to slide one upon another. Graphite produced in a colloidal form and added to lubricating oil has been shown to be adsorbed on the bearing face. It reduces interfacial tension by 15% and increases the critical temperature of an oil by 18° C., whilst the viscosity of the oil remains practically unaltered. Various proprietory graphited oils have a very wide range of application. H. G.

665.521.5 : 66.067.1 : 608.3

1084. Patents on Lubricating Oil. H. F. L. and H. N. Langlois and L. Mellersh-Jackson. E.P. 447,139, 13.5.36. Apparatus for clay-treating oils.

621.892.212 : 608.3

Atlantic Refining Co. and W. M. Malisoff. E.P. 448,424, 9.6.36. Production of lubricants by addition of a halogenated tricresyl phosphate to a viscous hydrocarbon oil.

621.892.212 : 608.3

H. F. Green. E.P. 448,507, 5.6.36. Lubricant comprising a mixture of sodium tauro-glycoholate, amyl lactate and a mineral lubricating oil.

621.892 : 608.3

J. Y. Johnson. E.P. 449,274, 24.6.36. Production of hydrocarbons of high b.pt. by converting Co and H_2 into hydrocarbons of higher mol. wt. than benzene by heating the gases at 20 atm. pressure and at 150–300° C. in the presence of anthracene oil.

621.892.099.21 : 608.3

Bataafsche Petroleum Mij. E.P. 449,311, 24.6.36. Lubricants for use at high temperatures, pressures and velocities are produced by adding to lubricating oils organic cyclic compounds containing groups in which the sulphur is bound to oxygen and halogen, *e.g. ortho*-toluene sulphochloride, *para*-toluene sulphobromide, chlorbenzene sulphochloride.

665.521.5 : 665.543.061.5 : 608.3

Standard Oil Development Co. E.P. 449,717, 2.7.36. Solvent extraction of lubricating oil after first de-asphaltizing using phenols, cresols, So_2, furfurol, etc. The product obtained is then hydrogenated, cracked, polymerized, condensed, or subjected to voltolization.

621.892.81 : 608.3

R. W. Asprey. E.P. 449,779, 3.7.36. Preparation of compounded lubricating oils and greases by adding to lubricating oil a quantity of rubber latex, and stabilizing with soft soap.

665.521.5 : 665.542 : 608.3

W. J. Sparks. U.S.P. 2,042,557, 2.6.36. Refining of lubricating oil by treating with molten sodium and air at 100–125° C.

665.521.5 : 665.543.061.5 : 608.3

E. B. Hjerpe and W. A. Gruse. U.S.P. 2,042,995, 2.6.36. Solvent extraction of lubricating oils using a mixture of ethylene dichloride and methanol.

665.521.5 : 665.543.061.5 : 66.062.182.2 : 608.3

D. R. Merrill. U.S.P. 2,043,388, 9.6.36. Solvent extraction of lubricating oil using liquid sulphur dioxide and benzene.

665.521.5 : 665.543.061.5 : 608.3

D. R. Merrill. U.S.P. 2,043,389, 9.6.36. Solvent extraction of lubricating oil using sulphur dioxide, $\beta_1\beta'$-dichloroethyl ether, nitrobenzene, aniline or furfural.

621.899 : 608.3

F. G. Baender. U.S.P. 2,043,691, 9.6.36. Process of reclaiming used lubricating oil.

665.521.5 : 665.543.061.5 : 608.3

H. T. Bennett. U.S.P. 2,044,603, 16.6.36. Manufacture of lubricating oils of high viscosity index from those containing constituents of high and low viscosity indices by solvent extraction, employing as solvent $\beta_1\beta'$-dichloroethyl ether.

665.521.5 : 665.543.061.5 : 608.3

F. X. Govers. U.S.P. 2,044,721, 16.6.36. Manufacture of lubricating oil from wax-bearing mineral oils using as solvent a mixture of *iso*propyl ether and aniline.

665.521.5 : 665.543.061.5 : 66.062.182.2 : 608.3

F. X. Govers. U.S.P. 2,044,722, 16.6.36. Manufacture of lubricating oil by solvent extraction using a mixture of liquid sulphur dioxide and commercial amyl alcohol boiling between 241° and 277° F., alcohol being the predominant portion.

665.521.5 : 665.543.061.5 : 608.3

F. X. Govers. U.S.P. 2,044,723, 16.6.36. Lubricating oil production from wax-bearing mineral oils by means of benzaldehyde and a solvent comprising benzole.

665.521.5 : 665.543.061.5 : 608.3

F. X. Govers, U.S.P. 2,044,724, 16.6.36. Solvent extraction of lubricating oil using a mixture of aniline and toluol.

665.521.5 : 665.543.061.5 : 608.3

F. X. Govers. U.S.P. 2,044,725, 16.6.36. Solvent extraction of lubricating oil using a mixture of benzaldehyde and amyl alcohol boiling between 241° and 277° F., benzaldehyde constituting 40–90% of the mixture.

665.521.5 : 665.543.061.5 : 66.062.182.2 : 608.3

F. X. Govers. U.S.P. 2,044,726. 16.6.36. Solvent extraction of lubricating oil using a mixture of liquid sulphur dioxide and *o*-dichlorbenzene and containing less than 50% of sulphur dioxide.

665.521.5 : 66.067.72 : 608.3

A. R. Moorman and J. C. Carpenter. U.S.P. 2,045,160, 23.6.36. Decolorizing lubricating oils using clay by means of a hot contact process.

621.899 : 608.3

H. G. Crowley and E. W. Riemenschneider. U.S.P. 2,045,216, 23.6.36. Reclaiming used lubricating oil by means of clay.

665.521.5 : 665.543.3 : 608.3

R. E. Manley, B. Y. McCarty and H. H. Gross. U.S.P. 2,045,305, 23.6.36. Dewaxing of lubricating oil by mixing it with a mineral lubricating oil extract of a pitch derived from recracking pressure tar of limited solubility in the oil, and chilling the mixture to separate the wax.

665.521.5 : 665.543.061.5 : 668.3

L. A. Clarke. U.S.P. 2,045,321, 23.6.36. Solvent extraction of lubricating oil using methyl acetate.

665.521.5 : 665.545.4 : 668.3

C. Winning and P. L. Young. U.S.P. 2,045,742, 30.6.36. Production of lubricating oils of low pour point by subjecting the lubricating oils containing asphaltic or resinous impurities to solvent precipitation and adding a synthetic pour inhibitor, *e.g.* low-temperature aluminium chloride condensation product of a chlorinated paraffin wax and naphthalene.

665.521.5 : 665.543.061.5 : 668.3

S. W. Ferris. U.S.P. 2,046,063, 30.6.36. Fractional extraction of mineral oil of viscosity gravity constant above 0·850 by means of ethyl acetoacetate to give an oil of viscosity gravity constant below 0·830.

665.521.5 : 665.543.061.5 : 668.3

S. W. Ferris. U.S.P. 2,046,064, 30.6.36. Process as described in U.S.P. 2,046,063 using acetylacetone for the fractional extraction.

665.521.5 : 665.545.3 : 668.3

E. J. Martin. U.S.P. 2,046,177, 30.6.36. Dewaxing of hydrocarbon oils using as diluent an ethyl ester of higher b.pt. than propionic ethyl ester and below 315° F.

W. S. E. C.

Paraffin Wax.

665.521.6

1085. Commercial Paraffin Waxes. J. M. Page, *Jr. Ind. Eng. Chem.*, 1936, **28**, 856.—The refractive indices and densities of five commercial paraffin waxes are given for the liquid and solid states over a range of temperatures. The mean refractive index in the solid state is calculated by means of Pope's equation from the values for the ordinary and extraordinary rays, and hence the specific refractivity calculated by means of the Lorentz and Lorenz formula. Although this formula is independent of the temperature and state of aggregation, the specific refractivities in the solid state were found to be variable, and not in complete agreement with the value found for the liquid state. The discrepancy is attributed to occluded air causing low observed density values for the solid state. Specific refractivities in the liquid state are shown to be in good agreement with the values derived from Eisenlohr's atomic refraction constants for carbon and hydrogen.

J. W. H.

665.521.6 : 665.541 : 668.3

1086. Patents on Wax. V. Voorhees. U.S.P. 2,045,425, 23.6.36. Improvement in wax sweating process.

665.521.6 : 665.543.061.5 : 668.3

L. G. Beynon. U.S.P. 2,045,567, 30.6.36. Separation of hard wax suitable for candle-making from soft wax associated therewith, by means of solvents, *e.g.* methane, ethane, propane or mixtures of these, or naphtha, benzene, trichlorethylene, etc.

W. S. E. C.

Fuel Oil.

662.753.32 : 621.43.019

1087. Second Report of the Volunteer Group for Compression-Ignition Fuel Research. T. B. Rendel. *J.S.A.E.*, 1936, **38**, 225–231.—This article deals with (*a*) suggested tentative procedure for operating the modified C.F.R. engine; (*b*) a recommendation as to the use of primary and secondary reference fuels; (*c*) the results of a series of

co-operative tests on the measurements of ignition quality of nine different types of diesel fuels. In the determination of ignition quality the delay method was used, the delay being measured by means of a modified bouncing-pin and a make-and-break contact timed to make the contact at the instant of fuel injection; a diagram is given which describes the circuit. As regards primary reference fuels, cetene numbers had previously been generally adapted, but successive batches have been found to have different ignition qualities, due, it is thought, to the presence of isomers. In consequence, cetane ($C_{16}H_{34}$) has been investigated. Cetane is stable and easily produced; its ignition quality is higher than cetene. α-methylnaphthalene ($C_{11}H_{10}$) is a satisfactory primary standard low reference fuel. The properties of each are as follows:

	Cetane.	α-Methyl-naphthalene.
Specific gravity @ $\frac{60}{60}$ ° F. .	0·775	1.025
Boiling range ° F. . . .	544·1/553	469·6
Freezing point ° F. . . .	61·5	−7·6
Iodine Number . . .	Nil	—

As secondary reference fuels, a straight-run gas oil has been chosen in place of cetane and commercial methylnaphthalene (a mixture of α- and β-methylnaphthalene) in place of the pure compound. A calibration curve is given of the reference fuel against mixtures of cetane and methylnaphthalene.

Tables are given of the ignition quality determined by the delay method of the nine fuels circulated, expressed in terms of the reference fuel, also expressed as cetane numbers obtained by reference to the curve previously mentioned. Another table describes the ignition quality as determined by the critical compression ratio method, but agreement is not so good as by the former method.

It is concluded that cetane number is the most satisfactory method for expressing ignition quality; further, that the delay method using the C.F.R. engine with high turbulent head appears at present to be the most satisfactory technique.

Appendices are given which deal with engine details and the physical properties of the nine oils circulated. W. A. W.

662.753.32 : 621.43.019

1088. Diesel Fuels—Significance of Ignition Characteristics. J. R. MacGregor. *J.S.A.E.*, 1936, **38**, 217–223.—A very full account is given of laboratory engine ignition tests, also of tests carried out under service conditions. The author has made use of critical compression pressures (C.C.P.) instead of critical compression ratios as used by other operators. Many curves are given, which include indications that engine speed will affect the proportions of reference fuel in blends required to obtain ignition at the same compression ratio, also that injection pressure influences the ignition of fuels of different viscosity. The author concludes that ignition quality of fuels may be greatly influenced by changes in operating conditions, also that service engines have distinct minimum requirements for fuel ignition quality, and, providing this minimum quality is exceeded, no difference in performance can be noted. Further, no correlation appears possible between laboratory rating of fuels and their service behaviour.

Smoke meters were used in these tests, consisting of a light source and a Photronic cell suitably mounted in the pipe fittings. W. A. W.

665.521.4 : 66.092

1089. "Uni-Coil Injection" Process. Petroleum Processes Co., Paris. *Petr. Zeit.*, 15.7.36, **32** (29), 1.—This process is used for the "viscosity-breaking" of oils by means of high-temperature cracking. Pure gas oil is pumped to a cracking zone maintained at 500° F., and the partly cracked oil is led to a soaking zone, where the "viscosity breaking" is effected. The temperature of this zone is 850–900°. The products are then passed to an evaporator, volatile constituents being separated. The cracked fuel oil is drawn from the bottom portion of the evaporator. The lighter fractions are fractionated.

The process is claimed to produce good anti-knock motor spirit and fuel oil of desired viscosity. A diagram is given of the plant. W. S. E. C.

665.58 : 665.335.9

1090. Liquid Fuels from Vegetable Oils. Anon. *Chem. Trade J.*, 1936, **99**, 80.—Semi-large scale trials have been carried out at Ségou in the French Sudan for the conversion of vegetable oils into motor spirit. Cottonseed has been carbonized in a furnace heated both externally and internally, with a capacity of 2 tons per day, the gas evolved being partly used for heating. Crude tar to the extent of 20–40% was obtained, this on distillation giving yields (based on 1 ton of original seed) of motor spirit 30 litres, burning oil 50 litres, diesel oil 100 litres, and pitch 50 litres. The economic possibilities of the process are limited by the drastic refining of the oils required, and it is suggested that catalytic cracking of the oil extracted by the usual methods has a better chance of success. C. L. G.

Asphalt and Bitumen.

665.521.8 : 620.178.4

1091. Mechanical Testing of Bituminous Materials. E. Neumann. *Asphalt u. Teer*, 1936, **36**, 377–382.—Various mechanical tests which have been suggested from time to time are surveyed, including the resistance to deformation under compression, etc., hardness, resistance to impact, resistance to moisture, etc.

C. C.

665.521.8 : 620.193.12

1092. Modified Accelerated Weathering Test for Asphalts and other Materials. O. G. Strieter and H. R. Snoke. *Bur. Stand. J. Research*, 1936, **16**, 481–485.—Three types of material were selected for this investigation: (*a*) asphalt surfaced on Al plates to a thickness of 0·025 in. and subjected to a cycle consisting of 19 hours' exposure to light and heat from a carbon arc lamp and 5 hours' immersion in distilled water at room temperature until the water was coloured a decided brown; (*b*) asphalt exposed outdoors to abundant sunlight, high humidity and practically no rain; (*c*) asphalt-saturated felt and smooth surfaced asphalt-prepared roofing.

(*b*) and (*c*) were immersed in water and solutions filtered to remove suspended matter. Then solutions from the three materials were evaporated to dryness and the residues dried at 105° C. These were quite similar in appearance, being brittle, black resin-like materials with an odour of burnt sugar. Each was found to be acid and to reduce Fehling's solution. The reducing substance could be precipitated by means of excess of basic lead acetate solution. This and other evidence pointed to the presence of ketone acids in the water-soluble material.

Bleached cotton cloth, wool cloth and sheet rubber behaved similarly after this exposure treatment, the water-soluble extract reducing Fehling's solution except in the case of wool cloth.

Tests were made to determine the function of light and O_2 on weathering of asphalt, and it was found that both are necessary for the production of the water-soluble products.

It is recommended that the modified accelerated test should be alternate exposure to the carbon arc lamp and immersion in distilled water at room temperature. The progress of weathering is followed by evaporating the aqueous solutions and weighing the residues.

It is suggested that this test should prove a valuable research aid in investigating the effect of anti-oxidants in asphalt, rubber, mineral fillers in asphalt, or in adhesion of asphalt to mineral granules. D. L. S.

665.45 : 66.094.3 : 608.3

1093. Patents on Asphalt. C. P. McNeil. U.S.P. 2,046,081, 30.6.36. Manufacture of asphaltic products by oxidation. W. S. E. C.

Special Products.

665.521.7 : 674.048

1094. Petroleum as an Impregnant for Wood. F. Moll. *Oel und Kohle*, 1936, **12**, 573–579.—Petroleum residues have not the requisite toxic properties and must be mixed with coal-tar oil. Miscibility with tar oil and ease of penetration into wood are influenced by the origin of the petroleum. P. G. H.

661.716 : 608.3

1095. **Patents on Special Products.** Wilmot and Cassidy, Inc., and T. A. Cassidy. E.P. 447,469, 19.5.36. Production of fluorescence in hydrocarbons by dissolving in the hydrocarbons predetermined quantity of dimethyl 6 : 12-coeroxinol.

661.715.33 : 608.3

E.I. Du Pont de Nemours and Co. E.P. 448,457, 8.6.36. Olefines are converted into sulphuric esters by allowing equimolecular quantities of olefine and sulphuric acid (75% concentration) to react in a narrow tubular vessel through which the reaction mixture is pumped at 25–30° C. The reaction product is hydrolyzed with water.

661.715.2 : 608.3

Gutehoffnungshütte Oberhausen A.G. E.P. 448,733, 15.6.36. Manufacture of formaldehyde and other products of the paraffin series containing more than one carbon atom in the molecule by oxidizing hydrocarbons with oxygen-containing gases in the absence of methane. Oxides of nitrogen are used as gaseous catalysts and solid catalysts of groups II or IV of the periodic system, together with one of the following : Cr, V, Mo, Al, W or Ni.

661.716 : 608.3

Bataafsche Petroleum Mij. and C. T. Kautter. E.P. 448,373, 8.6.36. Production of mono-alkylolamines containing not more than 5 carbon atoms in the molecule by allowing ethylene oxides, *e.g.* propyl or butyl oxide, to react with excess ammonia, preferably in the presence of water and in the liquid phase.

66.094.3 : 608.3

W. B. D. Penniman. U.S.P. 2,044,014, 16.6.36. Oxidation of oils with heat and pressure to produce alcohols, aldehydes, motor-spirit, and heavier fractions as varnish-thinners, kerosines, fuel oil, etc.

665.531.7 : 66.097 : 608.3

C. Winning and R. M. Thomas. U.S.P. 2,045,741, 30.6.36. Production of plastic products for use in paving, roofing and surface coating by treating cracked petroleum tar with aluminium chloride. W. S. E. C.

Combustion.

662.61

1096. **Carburation.** G. F. Gibson. *J. Inst. Aut. Eng.*, 1936, **4** (8), 32–60.—The author first outlines the requirements that have to be met in order to attain a satisfactory carburation system, and then deals with the problem of easy starting. It is considered that as regards Great Britain a satisfactory figure to work to is 20° F. if satisfactory starting is to be guaranteed under all conditions. Oil viscosity appears to be the factor which shows the greatest variation with temperature and affects the starter speed to the greatest extent. Using a modern 14 H.P. six-cylinder engine in a "cold room" it was found that induction depression varied between 0·4 in. Hg at 20 r.p.m. to 7 in. Hg at 132 r.p.m. One lb. sq. in. depression at probable starting speeds represents the only force available for vaporization, and a curve of induction temperature over a period of 3 mins. motoring at 114–136 r.p.m. with engine fully strangled shows that the fall in temperature in induction pipe is much too small to achieve vaporization. The author concludes, therefore, that most of the work of vaporization is dependent on the heat of the compression stroke. The temperature of compression at 100 r.p.m., and room temperature of 20° F. was found to be approximately 32° F., as small lumps of ice fixed to wires on the piston crown showed signs of melting when the engine was motored, whereas crystallized benzene remained solid. Under these conditions the mass ratio of petrol to air which gives a satisfactory start is about 20 times that which is chemically correct. The author describes a series of tests undertaken to determine the effect of fuel head, air bleed and discharge jet on mixture strength

variation using a 14 H.P. 6-cylinder engine and dynamometer, and as far as practicable the whole range of possible combinations of speeds and depression were covered. A full description and illustrations of the apparatus used are given. A special carburettor with submerged jet and air bleed was used. Petrol consumption was measured by means of conical-ended chambers fitted with gauge glasses at each end, and air measurement was effected by connecting the carburettor to an air box of 8 cu. ft. capacity to which was fitted a Kent's venturi, and to either side of the throttle plate in the venturi a pipe was connected, the pipe in turn being connected to a curved tube manometer. The author finds that for any fixed condition of carburettor and choke depression the fuel flow is not constant with change of speed, thus indicating that periodicity of induction pipe pulsations has a marked influence on mixture strength at a constant choke depression, the mixture becoming weaker as periodicity increases. Down-draught carburation is commented on, and details are given of an induction pipe which is claimed to give exceptionally good results. C. H. S.

Coal and Shale.

662.742

1097. Oils from Scottish Cannel. J. Jamieson and J. G. King. *Petr. Times*, 1936, **35**, 723.—Some details are given relating to a series of carbonization tests carried out on Scottish Cannel, of which some 20,000 tons were treated in continuous vertical retorts. The products obtained per ton of charge are as follows:—

	From Cannel	For Lothian gas-making coal.
Gas	26·500 cu. ft.	17·000 cu. ft.
Coke	9·5 cwt.	12·8 cwt.
Tar	50 gallons	16 gallons
Motor Spirit	43 gallons	2·5 gallons

The coke was stated to be of "satisfactory" quality, but appears to be much inferior to standard coke. The spirit has an I.B.P. of 70° C. (approx.) with 38% recovery to 100° C. The octane number (method not stated) is given as 70 and the composition: Unsaturateds 40%, aromatics 28%, saturateds 32%. The tar oils obtained are unsuitable as diesel fuel or for the production of lubricating oil. It is stated that Cannel tar is suitable for hydrogenation, and also that 100 gallons of tar will produce 105 gallons of motor spirit and 57 lb. paraffin wax, or, alternatively, 36 gallons spirit, 67 gallons diesel fuel and 57 lb. wax. The octane number of such spirit is given as 60, and the S.I.T. of the diesel fuel as 285° C. H. G.

662.742

1098. National Coke and Oil Coal Company's Carbonization Process. C. H. Lander. *Petr. Times*, 11.7.36, **36**, 41.—A summary is presented of the author's report on the working of the Tipton plant of the Company in question. During an observed 6-day run, 326 tons of coal were processed with "make-up" oil at the rate of 28·5 gal. per ton of coal. Coke was produced at the rate of 15 cwt. per ton of coal, finished motor spirit (for blending) and diesel oil at the rates of 12·25 gal. and 20·75 gal. per ton of coal respectively. The total number of retort hours running was 408. During a second test period of 27 days the total number of retort hours was 818, and 562·9 tons of coal were treated. Reduced quantities of "make-up" oil were used in order to reduce the production of diesel oil but the proportion of products obtained bore a relationship to the quantities of charging material similar to those indicated for the first test. The plant is now to be augmented by the installation of low-temperature coke equipment in order to render it self-supporting with regard to the supply of "make-up" oil. The report ignores the financial aspect of the process. H. G.

662.742 : 608.3

1099. Patents on Coal. H. E. Gotting and J. M. Brame. E.P. 448,279, 5.6.36. N. Consitt, J. Smith and R. E. Cowell. E.P. 449,619, 30.6.36, and H. A. Brassert & Co., Ltd., and A. Fisher. E.P. 449,870, 1.7.36. Improved processes for low-temperature carbonization of oils or tar or their mixtures with coal.

668.731 : 66.048 : 608.3

W. M. Bywater. U.S.P. 2,044,764, 23.6.36. Distillation of coal-tar to produce pitch and distillate oil and to recover tar acids as carbolate. W. S. E. C.

Economics and Statistics.

658.2 : 665.4/5(47)

1100. Petroleum Industry in the U.S.S.R. The Sredaznett Trust. I. Ganitzki. *Mon. Petr. Roum.*, 1936, **37**, 929–932.—The activities of this Trust extend over the regions of the republics Tadjikistan, Ouzbekistan and Kirghizia. The main fields are situated at Tchimiou, Kim (Santo or Sel-roho) and Chor-son (Kaganovitshi). Following exploratory work in recent years, all three fields have increased in size, and in 1937 it is planned to construct a refinery at Melnikovo. The productive sands of these areas, the "Fergana layer," are denser and less porous than those of the Baku region. It is thus that in the most favourable cases wells yield 300–400 tonnes a day and quickly fall off. However, drilling is easier than at Baku, and in 1934, 24,500 metres were drilled. The article reviews in detail the various localities in which exploratory work is in progress, notably the districts of Kop-Tchiagai, Tusluc, Tchangyrtas, Kstut-Zauran and Bukhara. An important formation in the latter district, viz. the Haoudag, situated in the valley of the Surkhan-Daria river, holds great possibilities. During the summer of 1935 a well here gave about 10,000 tonnes of crude in 36 hours, from a depth of 437 metres. In 1936 it is hoped that production will be over one million tonnes of crude. W. E. J. B.

658.2 : 665.4/5(47)

1101. Soviets Plan 100,000,000 Rbl. Oil Investment. J. Wegrin. *World Petr.*, June 1936, **7** (6), 324, 325.—This article analyses the Soviets investments in oil from 1927 to the beginning of 1936. During the first Piatiletka and the following two years of the second over 2000 million Rbl. were invested in Soviet oil. To-day the Soviet oil industry represents a value of over 2500 million Rbl., comprising working capital and all other assets. The pre-nationalization capital of the Russian oil industry was estimated to be less than one-third of the investments made by the Soviets between 1920 and 1934 or about half of the Soviet investment in oil during the first Piatiletka. Americanization of all field operations was started in 1924, but was not thoroughly advanced in the producing part of the industry, especially in drilling. During the years of reconstruction scarcely any attention was paid to exploration for new oil-fields to replace exhausted fields. In 1932 Grosni production fell from 64,000,000 to about 16,000,000 brl. High officials of the Soviets oil industry attributed the failure of their plans to defective supervision, inefficient management or inability to concentrate the resources of labour, supplies and equipment on the objective possibilities at their disposal. They entirely overlooked the urgent necessity of new exploration, and only after Stalin ordered the creation of a new oil base in the eastern regions have exploration and prospecting been undertaken with energy. The expenditure for the development of new fields and new horizons in the old fields has risen from 66,200,000 Rbl. in 1929 to over 100,000,000 in 1933, and exploration and geological research are now being emphasized. B. F. N. M.

658.2 : 665.4/5(729.87)

1102. Trinidad's Petroleum Industry in 1935. N. Betancourt. *Petr. Times*, 11.7.36, **36**, 37.—The production of 11,671,224 brl. of crude oil in 1935 is the highest recorded for the colony since the inception of the industry. Of this total 7,544,427 brl. were from Crown lands, and at the rate of 22·97 brl. per foot drilled and the balance from private lands at the rate of 38·29 brl. per foot drilled. The total value of the oil exported was less than in 1934, although the quantity exported was greater than in that year. The capacity of the six refineries in the Colony is 2,366,300 tons per annum. The refineries include two Dubbs plants, two Edeleanu refining plants, three gas absorption plants and one absorption plant for the recovery of gasoline from natural gas. Approximately 159 miles of pipe-lines are now laid, excluding the usual field and gathering lines. The total number of wells drilled is 2245 (1440 on Crown lands). Of these 118 were completed in 1935. Fourteen companies were operating at the close of the year, an increase of one during the year. H. G.

General.

658.2 : 665.451

1103. Researches upon Oil in Antiquity. A. Sequin. *Rev. des Questions Historiques*, Jan. 1936 (125), 3–41.—In the preamble this article points out that the innumerable writers on petroleum had not seen fit up to the present to revive the study of its history prior to 1858, the year when Colonel Drake drilled the first oil wells at Titusville. Except for a few scattered quotations, they have disdained to recognize that petroleum was known in the remotest antiquity. The texts in which it is interestingly treated are numerous, and the author has selected those which seemed to represent in the clearest way the views of the Ancients on the geographical position of oil deposits, their scientific knowledge of this product, and their methods of exploitation and utilization of oil.

The article begins by saying that oil was known in Antiquity in two forms: (1) Crude liquid oil—Naphta in Greek, Petroleum in Latin; and (2) Bitumen—Asphaltos in Greek and Bitumen in Latin. The word Naphta apparently comes from a Semitic root, the Hebrew word Naft.

The extracts are quoted from ancient Greek and Latin authors, in some cases being their translations into those two languages from the ancient Samaritan Hebrew of the Bible, from the Chaldean and from the Arabic. The Dead Sea was known in ancient times as Lake "Asphaltite," and, according to Tacitus, at a certain period of the year the lake threw up bitumen. Some of the best-known authors quoted are Pliny, Tacitus, Herodotus, Hippocrates, Xenophon, Ctesias and Plutarch, from whose writings it is abundantly clear that the Greeks and Romans knew of practically all the oil deposits in Asia Minor and in the neighbourhood of and on the shores of the Mediterranean, which are being exploited to-day.

On the composition and properties of petroleum the ancients had somewhat confused ideas about bitumen, the combustible mineral liquids, viscous or solid pitch and certain vegetable resins equally liable to combustion. Chemistry then being in its infancy and devoid of present-day instruments and appliances, the Ancients' ideas on inflammability, odour and consistence of the various substances gave petroleum a false reputation. One opinion held by many of these old writers was a certain affinity or relation between bitumen, petroleum and sulphur, so that one author declared that the distinction between black and white oil was that the first was bituminous and the second liquid sulphur. Among the authors quoted with regard to the properties of oil are: Aristotle, Ovid, Horace and Virgil. Throughout much of this ancient literature, medicinal, curative and antiseptic qualities are attributed to petroleum.

B. F. N. M.

BOOK REVIEWS.

Reviews.

621.436

DIESEL ENGINES OPERATION AND MAINTENANCE. L. H. Morrison. 214 pp., 118 illustrations. 1936, American Technical Society, Chicago. $2.25.

BEFORE entering into details of engine parts and their adjustments, the author devotes two chapters to a brief description of the principles of the internal-combustion engine, with particular reference to the diesel, and the evolution of modern principles of combustion is described partly in the form of an historical survey. A short chapter is also devoted to the installation of engines with reference to suitable foundations for different types, sizes, and varying soil. Chapters IV to VIII, consisting of 50 pages, deal separately with crankshaft and bearings, cylinders and liners, valves and gearing, pistons and con rods, and governors. In addition to practical advice regarding the overhaul of these components, these chapters give some technical information relating to design.

Chapter IX describes many types of nozzles for solid injection, and here again much information is given of special value to the maintenance staff. Air compressors for blast-injection engines are briefly dealt with, and in the chapter on cooling-water systems some information is given on water softening, with special reference to the Zeolite treatment.

The section of the book dealing with fuels gives details of the A.S.T.M. Tentative Classifications. The Conradson and Ramsbottom coke tests are also described, as also are the tentative standards dealing with ignitibility. The author outlines some of the factors governing the choice of the most suitable lubricating oil for different types of engines, and gives details of most of the tests used to determine the physical properties of lubricating oils. In this chapter centrifuges and filters are also dealt with. Chapter XIV is devoted to exhaust systems and waste-heat-recovery plants. Brief chapters deal with air filtration and starting systems. Instructions are given for starting and running, and most troubles likely to be experienced are tabulated with causes and remedies.

The book, which concludes with a useful glossary of terms in common use, should be of distinct value to the plant engineer and those interested in the practical side of diesel engine operation.

C. H. SPRAKE.

621.436

DIESEL ELECTRIC PLANTS. Edgar J. Kates. 181 pp., 108 illustrations. 1936, American Technical Society, Chicago. $2.00.

The first chapter of this book gives a short *résumé* of the characteristics of diesel engines, the types of electric generating plants for which they are most suitable, and a short analysis of costs compared with steam plants of equal capacity. The different types of A.C. and D.C. generators used with diesel engine drive are next described in their various classes. Chapters III and IV, consisting of nearly one-third of the book, give detailed descriptions of a large number of voltage regulators used in A.C. and D.C. machines, together with circuit diagrams showing their application to the generating plant. The methods employed in running generators in parallel is next described. The first half of the book up to this point, with the exception of the first chapter, deals almost exclusively with electrical matters.

The author then passes on to describe the problem of satisfactory governing of diesel engines used to drive generators. Several governors of mechanical and hydraulic types and the methods adopted for controlling frequency are dealt with. Chapter VII describes the advantages of fully automatic control, and the general practices adopted to this end both on the engine and generator side are enumerated. Chapter IX gives in tabular form the routine procedure generally adopted in putting electric generators in and out of service. The next chapter describes automatic devices for the control and safeguarding of the engine itself. These include control for jacket temperature, speed, oil pressure, bearing and exhaust temperatures and overload. A short chapter gives a description of diesel locomotives, together with some comparative performances of diesel and steam power in this field.

The book concludes with general directions regarding the installation of generators and voltage regulators generally, and probable causes of various troubles in different parts of the generator are tabulated.

Much information is given in a concise form throughout the book which should be of value to the plant engineer, although more information is given on the electrical than on the mechanical side.

C. H. SPRAKE.

622.323

PETROLEUM DEVELOPMENT AND TECHNOLOGY, 1936. 536 pp. 1936, American Institute of Mining and Metallurgical Engineers, New York. $5.

Petroleum Development and Technology, 1936, contains selected papers and production statistics presented at the several meetings of the Petroleum Division of the American Institute of Mining and Metallurgical Engineers held during the year 1935. This annual compilation constitutes an almost complete review of the oil production situation in the U.S.A., together with a summary of the production position in each of the major oil-producing countries of the world.

Chapter I deals with the estimation of petroleum reserves, and two of the papers presented are of a mathematical nature. In both instances, given sufficient and proper data on production, reservoir pressure behaviour and the properties of the oil and gas, calculation of the initial oil and gas content of reservoirs is possible.

Production Engineering is dealt with in Chapter II, and nine papers are included. A number of other papers are referred to in the contents, and their references are quoted. Such subjects as vertical flow of gas–liquid mixtures, structures of clay gels, determination of surface tension and specific gravity of crude oil under reservoir conditions, determination of sucker rod loads, acid treatment of oil-sands, recovery of oil from sandstones by gas drive, water flooding, shutting off water in oil and gas wells and plug-back cementing methods, are considered.

Experiments on the vertical flow of gas–liquid mixtures carried out in glass pipes are described. The object of these experiments was to study the factors involved in the flow of these mixtures in the flow strings of wells.

The paper on structure of clay gels is a continuation of a paper, by the same authors, dealing with the behaviour of clay suspensions. In the present paper the authors endeavour to show that the behaviour of clay gels is due to the same factors that affect clay suspensions. Insight into the mechanism of gelation is of outstanding importance in the consideration of drilling muds.

The article on the determination of surface tension and specific gravity of crude oil under reservoir conditions has been published previously in the *Proceedings of the World Petroleum Congress*, but the importance of the subject warrants this repetition.

The author of the paper on the investigation of experimental methods of determining sucker-rod loads shows how analogies and models can be applied to the solution of the various operating problems.

Acid treatment of oil-sands is dealt with, and the results show that if the limestone is fine-grained and impure, the insoluble residue dissolved from the core by the acid is in granular and minute acicular crystals larger than the pore spaces in the rocks. This material thus clogs the core and decreases permeability, irrespective of how much washing and swabbing is done to clean it.

Investigations on the recovery of oil from sandstones by gas drive have been carried out with the idea of determining the effect of the sandstone and the viscosity of the oil on the production of oil in the case where no expansible gas is dissolved in the oil.

Available data on existing water-flooding operations, with a survey of the region and the extent to which application of the method seems most likely to be made, are given in an article on water flooding in the Mid-Continent.

Chemical methods for shutting-off water in oil and gas wells and plug-back cementing methods complete the section on Production Engineering.

The section on statistics is, as usual, excellently compiled, and contains more information than has been the case previously.

The papers are authoritatively written, and credit is due to the compilers for the manner in which they have been presented. The book should serve as a valuable work of reference for some time to come.

L. V. W. CLARK.

ABSTRACTS.

	PAGE
Geology	418A
Geophysics	424A
Drilling	428A
Production	432A
Pipe-Lines and Transport	435A
Storage	435A
Chemistry of Petroleum	436A
Physics of Petroleum	437A
Analysis and Testing	438A
Gas	439A
Crude Oil	440A
Refining and Refinery Plant	441A
Corrosion	446A
Cracking	446A
Hydrogenation	450A
Polymerization	450A
Motor Fuels	451A
Lubricants and Lubrication	453A
Wax	458A
Fuel Oil	458A
Asphalt and Bitumen	461A
Special Products	462A
Engines	465A
Detonation	467A
Coal	468A
Reviews and Books Received	470A

AUTHOR INDEX.

The numbers refer to the Abstract Number.

Abagy, W. A., 1134
Adams, W. C., 1177
Albright, J. C., 1129, 1180, 1175, 1213
Alco Products Inc., 1217
Alexanian, C. L., 1185
Anderson, A., 1127
Anderson, G. H., 1217
Angell, C. H., 1190
Anheton, E., 1244
Atwell, H. V., 1199

Baker, J. G., 1139
Baklanov, B., 1144
Barkelew, J. T., 1134
Barton, C. H., 1226
Batnafache Petroleum Mij., 1217
Bauer, S. G., 1230
Beall, I. N., 1170
Beard, R. E., 1219
Bell, A. H., 1149
Bennett, E. O., 1134
Berger, C. W., 1207
Bethlehem Steel Co., 1191
Bettis, W. L., 1134
Bird, A. L., 1220
Blau, L. W., 1119
Boerlage, G. D., 1229
Boliden Gruvaktiebolag, 1173
Bray, U. B., 1217
Brashnikov, V. T., 1205
Breton, J., 1264
Bristow, W. A., 1255
Breese, J. J., 1229
Brown, C. J., 1185
Brown, R. S., 1208
Brown, G. G., 1184
Buck, E. O., 1153
Bukh, D. N., 1222
Burkhard, M. J., 1191

Calderwood, A. H., 1231
Cannon, M. R., 1215
Carpenael, A., 1201
Carr, D. E., 1217
Cawley, C. M., 1230
Chatfield, H. W., 1237
Chittick, M. B., 1217
Clapp, F. G., 1109
Clark, J. M., 1192
Clasen, A., 1154
Cooke, M. B., 1199
Coutts & Co., 1200
Crackett, L. O., 1217
Cryder, D. S., 1182

Davis, H., 1191
Davis, H. M., 1158
Day, R. B., 1208, 1217
Diehl, W. L., 1154
Diggs, S. H., 1219
Doldi, S., 1204
Dolton, R. H., 1190
Donnelly, J. F., 1199
Dubbs, L. A., 1199
Du Pont de Nemours & Co., E.I., 1200

Egloff, G., 1194, 1195, 1224

Fenske, M. R., 1182, 1183, 1215, 1217
Fischer, E. J., 1232
Fisher, A., 1199
Fister, L. H., 1191
Fitz Simons, O., 1208
Forney, W. E., 1198
Fortine, D. H., 1174

Garner, F. H., 1228
Geisler, W., 1234
Gerr, V. F., 1241
Givaudon, J., 1221
Golendeev, V. P., 1242
Goss, H. F., 1217
Govers, F. X., 1217
Grigor'ev, V. M., 1236
Groote, M. de, 1177
Gross, H. H., 1217
Gruse, W. A., 1217
Guenter, R. A., 1132
Guyer, J. A., 1191

Hagemann, A., 1225
Hagerman, T. H., 1104
Hammerich, T., 1225
Hancock, W. T., 1191, 1199
Harger, D. K., 1217
Harris, H. A., 1120
Hartnell, G., 1116
Hassler, G. L., 1134
Haylett, R. E., 1216
Hecht, M., 1217
Heilman, R. H., 1191
Heisig, G. B., 1158
Henny, V., 1217
Hjerpe, E. B., 1217
Holsen, E. P., 1180
Hoots, H. W., 1113
Hottel, H. C., 1187
Houdry Process Corpn., 1191
Howard, J. H., 1134
Howard, W. R., 1199
Howes, R. T., 1208
Hubner, W. H., 1224
Hultin, C. T., 1193
Huntington, R. L., 1154, 1172
Hupkes, W., 1252
Hyatt, D. L., 1112

I.G. Farbenindustrie A.-G., 1199, 1245
Ipatieff, V. N., 1201
Isom, E. W., 1199
Israel, R. G., 1173
Ivanova, E. G., 1166

Jessen, F. W., 1164
Johnson, E. E., 1134
Johnson, J. Y., 1173, 1199, 1245
Johnson, S. S., 1217
Jones, C. L., 1217
Jones, D. G., 1243

Kalantar, N., 1210
Kaplan, W., 1198
Karcher, J. C., 1119
Kaiser, B., 1177
Keith, P. C., 1190, 1216
Kellogg, C. M., 1217
Kemler, E. N., 1141
Kennedy, R. R., 1165
King, J. G., 1220
Kingston, B. M., 1136
Kleinert, H., 1234
Kok, W. J. C. de, 1167
Komarewsky, V., 1201
Kostrin, K. V., 1179
Kovol'chuk, M., 1210
Krutter, H. M., 1107
Kudinov, A. V., 1241
Kyropoulos, S., 1209

Lacey, W. N., 1163, 1165
Lasser, B. E., 1193
Laurent, R., 1223
Leahy, M. J., 1171
Legataki, T. W., 1203
Le Mesurier, L. J., 1229
Leming, R., 1256
Leyendecker, C., 1121
Liberthson, L., 1217
Lichtfoot, J. H., 1164
Loebel, A., 1201
Lorne, H. T., 1235
Louis, M., 1223
Lovell, W. G., 1248, 1249
Lowry, C. D., 1258
Lugt, G. J., 1251
Lynch, T. L., 1134

Mair, B. J., 1216
Maliyants, A. A., 1105
Maluishek, V. T., 1105
Mann, C. A., 1193
Marsh, L. E., 1245
McAfee, A. M., 1217
McCluer, W. B., 1217
McCullough, G. W., 1156
McKay, C. W., 1191
McMillan, W. A., 1159
McNish, A. G., 1118
Melberg, C. O., 1199
Metrot, M., 1223
Meyer, F. W., 1187
Mikesha, L. A., 1211
Mills, R., 1114, 1148
Mizabe, N., 1117
Mock, F. C., 1250
Moore, A. D., 1160
Morrell, J. C., 1208
Munteanu, M., 1199
Murphy, D. F., 1238

National Aluminate Corpn., 1191
Nelson, E. F., 1194, 1195
Nelson, W. L., 1202
Nutt, D. B., 1208

Obryadchikov, S. N., 1196, 1197
Ocon, E. A., 1199
O'Connor, D. L. T., 1134
Opryshek, J., 1217
Orelup, J. W., 1245
Osterstrom, R. C., 1201
Overbaugh, W. V., 1217

Padgett, F. W., 1217
Page, J. M., 1219
Parkhomenko, V., 1212
Patrick, R. E., 1140
Patterson, W. E., 1134
Penick, A. J., 1134
Penick, K. T., 1134

Pilat, S., 1189
Pilsov, A. K., 1242
Post, R. S., 1132, 1176
Potts, H. E., 1200, 1245
Prescott, H. R., 1119
Prévost, E., 1227

Quiggle, D., 1182

Rawlins, E. L., 1151, 1152
Reed, P., 1143
Reginskaya, V., 1210
Reinfeld, E. A., 1105
Renfrew, P. B., 1245
Rhodes, F. H., 1192
Rilling, H. L., 1134
Rinman, E. L., 1200
Robertson, H. J., 1177
Rodman, C. J., 1217
Rosenau, I. R., 1253
Ruhrchemie A.-G., 1208

Sack, W., 1146
Sage, B. H., 1163, 1165
Sanders, T. P., 1131
Sawdon, W. A., 1124, 1137
Sawyer, T. K., 1127
Scantlebury, H. E., 1134
Schellhardt, M. A., 1151, 1153
Schicktanz, S. T., 1216
Schmidt, E. F. E., 1169
Scholtes, F. X., 1134
Solster, K. C., 1126
Scott, F. L., 1134
Scott, N. D., 1208
Searey, F. L., 1119
Seguy, J. D., 1199
Shaw, S. F., 1145
Shell Development Company, 1231
Shephard, J. H., 1217
Shishebenko, R., 1144
Sigwalt, R., 1221
Singer, S. C., 1184
Skowronski, F. J., 1206
Slagter, A. J., 1191
Smith, R. L., 1134
Snoigr, D. S., 1198, 1130
Soc. Franc. de Catalyse Générale, 1173
Sokolov, W. A., 1106
Squires, F., 1135
Stansfield, R., 1229
Statham, L., 1119
Stearns, W. V., 1217
Stephenson, H. P., 1173
Sterrett, E., 1149
Stevens, H. F., 1134
Stewart, I., 1187
Stone, F. W., 1191
Story, LeR. G., 1199
Stratford, R. K., 1217
Sullivan, P. H., 1199
Swindell, F. L., 1133

Taylor, F. B., 1125, 1138
Tears, C. F., 1217
Thompson, J. L., 1168
Titeica, R., 1162
Tongberg, C. O., 1182
Traxler, R. N., 1233
Triggs, W. W., 1245

Vanderberg, G. B., 1238
Varteressian, K. A., 1183
Vichnievsky, R., 1246
Vickers, R. N., 1134
Volck, W. H., 1217
Vorizhtsov, N. N., 1236

Wagner, C. R., 1201
Walt, J. F., 1217
Wales, J. A., 1190
Waschcck, G., 1119
Waterman, H. I., 1167
Wayne, T. B., 1177
Weber, G., 1214
Webster, D. C., 1163
Weckel, G. H., 1149
Weir, H. M., 1217
Werner, C., 1139
Westen, H. A. van, 1167
Westsmith, J. W., 1198
White, A. R., 1245
Wiegrand, W. B., 1243
Williams, N., 1122
Wilson, A. M., 1217
Wilson, R. E., 1216
Wilson, R. R., 1184
Wirtel, A. F., 1177
Wohlenberg, W. J., 1188
Wood, H., 1247
Woods, G. M., 1206
Woog, P., 1221

Yancey, J. R., 1134
Youker, M. P., 1208

Zel'tzburg, A. I., 1242
Zil'berman, G. B., 1238

Geology.

551.7(22)

1104. Investigations into the Clastic Material in the Formations of the Argentine North. T. H. Hagerman. *Bol. Inform. Petroleras* (*B.A.*), March 1936, **13** (139), 75–120.—This 45-p. article (of which about 20 pp. are occupied by maps, plates, sections, profiles and diagrams) is divided into three parts. Part I is headed Theory and Method, general consideration of the genesis of the sediments and granulometric method of the author. At the outset he lays down three chapters in the genetic history of a sediment: (1) The epoch of pre-transport, during which the first materials of a sedimentary stratum appear in transportable form. (2) The time of transport, when the individual-transported solids receive each their definite form. A selection of the sediment is made so that the least transportable material soon disappears from the mass, but often the transporting medium is enriched again by material re-elevated and deposited anew. (3) The moment of deposition, the final deposition by the medium of any one process such as chemical precipitation (sedimentation in a limited sense) and dragging along the bottom of the basin. The two types of granulometric analysis (prefaced by reference to the author's paper, "Some Lithological Methods for Determination of Stratigraphical Horizons," World Petroleum Congress, London, Vol. 1, pp. 257–259), are then described as: (1) The determination of one element alone, the size of the grain. (2) The determination of a principal element, of the most representative section or projection of the grain; the relative width. The first of these methods has its applications principally in the work of orientation, whilst the second has given very exact indications in stratigraphical work. Classification of the size of the grains is done by determining an intermediary parameter of the grain, the measurements being effected under the microscope, then the study to determine the curve of distribution of the grains with the greatest parameters in one sand can be undertaken, as also the variations of the sizes of the grains in a stratigraphic series. The determination of the relative width of the grains is fully discussed and the methods of doing it are described.

Part II is the descriptive outline of the stratigraphy of the Argentine North, thereafter dealing with the granulometric determination of the various rock formations, which for the purposes of the figures are taken in ascending order, the lowest and oldest rocks (believed to be Silurian) being lettered with a Capital Z and the Quaternary with a Capital S, the subdivisional series of the main divisions being designated by the small letters i (inferior), c (central) and s (superior) attached to the capital letters, to indicate their positions in the main divisions.

Part III comprises the opinions and conclusions formed during some years of detailed study on the genesis of regional sediments. Briefly the history is that terraces of

accumulation are built up in the zone whence the sedimentary material and the transporting material originate. In the process of terrace formation there is a relative separation of this material. Over the terrace various forces act in repetition to augment the mass of particles; at the same time the grains are abrading each other. The predominant factors in the collection of the particles into masses are the physical conditions of the terrace and of the current of the transporting medium, of which the velocity of the current is the master force. Erosion first attacks a certain part of the terrace, then the current carries the eroded material over the basin of the sedimentation, which may be marine, lacustrine or fluviatile. The current, when it reaches the proximal part of the basin, will probably lose, temporarily, a part of its velocity, and it will then begin to deposit a certain amount of its particles, the quantity and size being determined by the minimum strength to which the velocity is diminished. Later a fresh flood impulse pushes forward the transporting fluid, increasing anew its velocity, until it reaches another part of the basin, where the velocity is checked and there sinks down a deposit which has lost some of the coarser material at the first velocity diminution. So the fluid goes on until, on arrival at the furthest point in the basin, it deposits a much finer material than that in the nearest part of the horizon.

The author finishes with a tribute to the official heads of the Y.P.F. for the interest and help given him in his studies, and expresses the hope that his work, while it may be only a step in solving the great problems of the genesis and construction of the thick formations of the Argentine North, will help in the final object of arriving at structural correlations which will show the way to discovery of the oil which exists in the terrace. B. F. N. M.

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1105. Geochemical Importance of Sulphur Bacteria in Petroleum Waters. V. T. Maluishek, A. A. Maliyants and E. A. Reinfeld. *For. Petr. Techn.*, 1936, **4**, 245.—After extensive studies it is concluded that: (1) The cause of the coloration of the "pink" waters of the Upper Kirmaki I Producing Layer of the Ordzhonikidze oil-field obtained at a depth of 1300–1600 metres are the purple sulphur bacteria detected by microbiological investigations on waters in certain bore holes; (2) together with the purple bacteria in all the investigated samples, thio-sulphur bacteria were found; (3) in the same samples were also found rich microflora, i.e. bacteria causing H_2S fermentation as well as denitrification; (4) in the colourless as well as the "pink" waters an increased sulphate content was observed, being due to sulphur bacteria; (5) together with the reduction of the sulphates in the bore-hole waters, reversible processes were noted that play an important rôle in the geochemistry of sedimentary deposits. 25 references. G. R. N.

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1106. Gas Exploration. W. A. Sokolov. *Rev. Petr.*, 12.9.36 (700), 1381–1385.—The author begins by stating four conditions which must be fulfilled to account for the existence of oil- and gas-fields in any explored region: (1) Existence of genetic rocks. (2) Existence of reservoirs where oil and gas can accumulate. (3) Existence of favourable structures in which to store the hydrocarbons in commercial quantities. (4) Existence of a suitable covering to prevent the escape of the petroleum and its eventual dispersion in the atmosphere. Seepages of oil or gas only prove that the first condition is fulfilled, which by itself is quite insufficient to determine the existence of an oil-field, its extent and its exact limits. Again, the presence of favourable structure alone does not necessarily prove that a commercial accumulation of petroleum exists within it. The seismic, gravimetric and electric geophysical methods can bring powerful aid to the geologist and give valuable information on the structure of the explored region. Nevertheless all the geological surface evidence and the geophysical predictions can only lead to indirect deduction, such as the more or less probable presence of generating oil-beds, the existence of reservoirs, favourable structure, etc., for they do not reveal the position and contours of the actual petroliferous horizon. Such reasoning has often been erroneous, causing useless expenditure and delaying exploration.

The author now propounds a new method of oil-finding based on the micro-analytical

measuring of combustible gases in the air of the superficial beds. This "Gas Exploration" entails the uniform sampling of the air in the soil to depths from 2 to 10 metres and the subsequent treatment of the hydrocarbons contained in these air samples. This treatment is effected by the aid of a special apparatus allowing the determination separately of the light and heavy fractions of the combustible gases. It is, moreover, based on the supposition that small quantities of hydrocarbons pass from a petroliferous stratum into the superficial beds, and are dispersed finally in the atmosphere by the phenomena of diffusion and effusion. This postulates a continuous current of gas from the petroliferous stratum towards the atmosphere across all the covering strata. The quantity of gas able to escape from the oil horizon into the atmosphere must be very slight. The plant used for this study must, therefore, possess high sensitivity. The possibility of a diffusion of hydrocarbons across the geological beds towards the atmosphere has been considered in many works on Petroleum Geology, while good geological coverture to prevent dissipation from a petroliferous stratum is granted to be indispensable to the existence of a commercial accumulation of oil, yet generally a stratum can, up to a limit, yield a part of its volatile components to the atmosphere. Elementary physics teaches that even a solid possesses the property of diffusion into other solid bodies, *e.g.* gold into lead, the classic example. Gases are still more susceptible to penetration into solid bodies. Rocks always have a certain degree of porosity. Porosity can be divided into three types: (1) An ordinary or super-capillary type measuring 0·5 mm. and above; (2) capillary between 0·5 mm. and 0·0001 mm. in size, and (3) pores with dimensions smaller than 0·0001 mm. In this last case rocks have an appreciable permeability for gases, which must be still greater for the first two types. The laws governing the passage of gases varies with the type of porosity. In case (1) the gas traverses the rock circulating freely in the existing channels without any modification of its composition. In the second (filtration) the passage speed of the gas will be inversely proportional to the $\sqrt{d}$, where d = the density of the gas. The law for the third case has not yet been formulated, but we know that carbonic acid gas (heavy gas) traverses rubber far more rapidly than a light gas, such as hydrogen. Certain rocks may possess analogous properties. Also gas passage through rocks more or less hydrated will depend similarly on the solubility of the gas in the water. From the above exposition it appears that the passage of hydrocarbons from a petroliferous stratum to the superficial beds is perfectly feasible. The whole problem is inherent in the importance of this phenomenon. According to the fundamental theory of "Gas Exploration," a petroliferous stratum should manifest itself at the surface in the form of traces of petroleum vapours or gas, on finding which the presence of an oil horizon at an undetermined depth can be concluded. Furthermore, the division of the hydrocarbon traces can give indications of the exact position of the petroliferous bed. Therefore "Gas Exploration" is put forward as a prospecting process for application to the direct finding of petroliferous strata. By analogy with geophysical methods, it can be considered as being chemical or geochemical, since it is based on chemical analysis. It is, in fact, an intrusion of physical and chemical methods of research into the domain of geological exploration.

The author then discusses some essential factors which are linked to the practical application of "Gas Exploration," and traces the history from 1928 of the evolution of a sufficiently sensitive apparatus of analysis to reveal amounts of hydrocarbons in the air of superficial rocks as small as 0·001%. In 1932 the apparatus had been so far perfected and the laboratory facilities so much increased as to permit of the making of an enormously increased number of analyses of samples taken from extensive areas in the regions of Baku, Grosny, etc. An apparatus had been constructed which was capable of treating and measuring the quantities of combustible gases in the air of the superficial beds to the small amount of from 0·001 to 0·0001%. The apparatus and the process of analysis are explained at some length and the field work on certain of Russia's oil regions is described with five figures and one table to illustrate what the new exploration method claims to have proved from its analyses.

In conclusion the author states that as a rule a high content of heavy components is observed in petroliferous regions, but, if the composition of this fraction is not known, its presence can be attributed to the existence of a petroliferous stratum or of some other deposit such as coal, oil shales, etc., capable of giving organic components which could assemble in the heavy fraction. To determine the composition of the

heavy fraction, it is advisable to begin by burning it, so that one can reach several conclusions as to the composition of the heavy fraction on the basis of the quantity of carbonic acid gas formed by the combustion. When a "Gas Exploration" section intersects a dome in an anticline which reveals a petroliferous horizon with a gas cap, one can expect to find above the gas cap a maximum ratio between methane and the heavy hydrocarbons. In the case of total combustion, the ratio between the quantity of carbonic acid gas formed and the volume of the hydrocarbons will be a minimum above the gas cap. For a more exact determination of the heavy fraction, a more detailed analysis is required. "Gas Exploration" operations already performed have shown the possibility of its practical application, but research work must be continued as much to perfect the methods as to develop the theory.

B. F. N. M.

553.982

1107. Nomographs for the Calculation of Permeability. H. M. Krutter. *Oil & Gas J.*, 16.7.36, **35** (9), 40.—The author presents a series of nomographs for the calculation of the permeability of a core. The charts enable permeabilities to be calculated from 10 to 1000 millidarcies, permeabilities up to 50 millidarcies applicable to regions where sands are tight, and for radial gas flow. L. V. W. C.

553.982(569.11)(569.34)

1108. Further Oil Exploration in the Near East. *Petr. Times*, 1.8.36, **36**, 147.—Syria and Liban are a continental area with a relatively thin cover of sediments, and basins similar to that which yields oil in Iraq. There are two main provinces. The eastern desert zone, between the Tigris and Djebel Bichri on the right bank of the Euphrates, is considered a part of the edge of the Iraq Basin, with the same, but thinner sediments. A number of domes are known. Karatchok Dagh, in the extreme north-east of Syria, is 30 km. long; Khatounie, Dj. Tchembe, Dj. Djibissa, at the eastern end of Dj. Sindjar, and a number of domes in eastern Bichri are cloaked by Lower Fars. In the Mediterranean coastal zone are numerous bituminous limestone patches, usually of Campanian or Lower Maestrichtian age, *e.g.* near Jerusalem and Beersheba in the Dead Sea region. Near Lattaquie is a small, dark oil seepage from the Senonian, and a clear, paraffin-base oil seepage occurs in the Mollasse 17 km. south-west of Alexandretta. Hydrocarbon gases escape from the flanks of Kizil Dagh.

G. D. H.

553.982(569.4)

1109. Geology and Bitumens of the Dead Sea Area, Palestine and Transjordan. F. G. Clapp. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 881–909.—The Dead Sea lies in a graben, 225 miles long and trending in a N.-S. direction. The surface of the water is 1292 ft. below the level of the Mediterranean, and the lake is divided into two parts by the peninsula of El Lisan, the S. part being very shallow. There is evidence of a steady rise in level of the water.

Cambrian rocks are exposed in a few places. Next in succession are the Jurassic and Cretaceous rocks, which form prominent outcrops of sandstone and limestone over large areas. There is an unconformity at the top of the Senonian. Eocene and Miocene rocks are poorly represented, whilst the main deposits of Pliocene age are in the depression at the S. end of the lake.

The tectonics of the area are still a matter of controversy. Gregory's rift theory has been opposed by Willis, who has suggested that the term "ramp" is more appropriate. The fault planes enclosing the graben are not simple, normal faults, as Gregory believed, but rather they indicate thrusting. They do not extend throughout the entire length of the graben; instead, they bend away from it, giving an en echelon effect. It is the behaviour of these faults that led to Willis rejecting Gregory's rift theory.

The Jebel Usdum is a salt plug rising to a height of 742 ft. above the lake at its S. end. The lower part is almost pure rock-salt, and this is capped by red, grey, and green gypsiferous marls. It is intrusive in the Usdum series (Upper Mioc.–Plioc.), but there is no direct evidence of its age.

Oil-saturated sands are found in the Wadi Mahawuat near the S.W. corner of the Dead Sea. The oil probably came from a fault between the Dead Sea tertiaries and the Upper Cretaceous rocks of the uplands. Oil seepages are also seen in the Wadi Sebbeh, where the oil exudes from dolomitic rocks, Turonian or Upper Cenomanian in age. The main occurrences, however, are in the form of masses of bitumen floating in the lake itself and of bituminous rocks. Large masses of pure black bitumen rise in the S. half of the lake. Bituminous impregnations are found in a number of localities in the Jurassic sandstone and the Upper Senonian limestones. Source rocks may be present in the Upper Senonian, whilst suitable reservoirs are known to exist. Adequate cover is provided inside the graben by the Tertiary rocks. S. E. C.

553.982(76)

1110. Geology of White Point Field Requires Careful Drilling. Anon. *Oil & Gas J.*, 20.8.36, **35** (14), 75–76.—At the end of 1935 20 acres of oil and gas and 3865 acres of gas-bearing formations had been developed. These productive beds form a dome, but drilling to 7211 ft. and into the Frio formation has not given evidence of the salt dome first suspected from the H_2S seepages and disseminated sulphur.

The productive horizons are the Lagarto and the Middle Oligocene, at 2375 ft. for the gas-sand and 4902 ft. for the oil zone. Several gas-sands occur round 3840 and 3880 ft., and gas has been obtained from semi-consolidated sands. There have been bad blow-outs and cratering from the high-pressure gas met in some wells.

The Lissie-Reynosa non-marine formation has two oil-bearing horizons. There are eight oil-bearing horizons in the non-marine Miocene, and two in the marine Oligocene. The position of the Miocene–Oligocene contact is in doubt. Sands are lenticular, and water-sands may closely overlie some oil-sands, as at Saxet.

G. D. H.

553.982(76)

1111. Sub-Surface Geology in Saxet Field. Anon. *Oil & Gas J.*, 20.8.36, **35** (14), 72.—Saxet lies west of Corpus Christi. At first gas was produced from shallow sands. Later some oil-sands were found at depths of 2300–5850 ft. Most of the productive sands are lenticular. Faulting is important, and there may be a deep-seated salt intrusion. The Frio sand at 5800 ft. is the prime producing horizon now. It corresponds with the Heep sand, which gives much of the production at Plymouth to the north in San Patricio County.

The structure of the Frio sand is not the same as that of the shallower beds. The interval from the top of the Heterostegina zone to the 5800 ft. thickens by over 100 ft. to the W. and N.W., and this thickening has given closure. There is a south-easterly dipping syncline which nearly divides the sand into two distinct structures, giving the appearance of two domes on the upthrown (N.W.) side of the major fault which runs N.E.–S.W. from Viola to Clarkwood. The fault has caused accumulation in the Frio sand on its upthrown side. The northern dome is just S. of Viola, and the southern dome is N.W. of Clarkwood. The porosity of the sand is fairly constant (about 28%). The oil-sand covers about 2250 acres, and the average thickness is probably not more than 25 ft. The calculated reserves are 46,000,000 brls. of oil and 30,000,000,000 c. ft. of gas. The original pressure in the sand was 2600 lb./sq. in. Oil of 39·7° A.P.I. gravity is produced.

In the northern part of the field there is a restricted sand at 5725 ft. Near Clarkwood a sand at 4400 ft. has been developed extensively of late. Its average thickness is 12 ft., and it yields oil of 28° A.P.I. gravity with a closed-in pressure of 900–1500 lb./sq. in. A sand at 4800 ft. is thinner (about 6–8 ft.), and irregular, with numerous shale breaks. It gives 25° A.P.I. gravity oil from about 50 wells. The casing pressure is 1500 lb./sq. in. Deeper production is possible. G. D. H.

553.982(766)

1112. Preliminary Report on the Fitts Pool, Oklahoma. D. L. Hyatt. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 951–974.—The Fitts pool lies in the Franks graben, 2½ miles N. of the Arbuckles and in the S.E. part of Pontotoc county. The first producing well came in in July 1933, and the present extent of the field is approx. 5 × 1½ miles.

Production is obtained from the McLish, Bromide, and Viola formations (Ordo-

vician), the Hunton limestone (Silurian–Devonian), and the Atoka formation (Pennsylvanian). Gas is also found locally in the McAlester formation (Penn.), and production may be expected from the Union Valley sand of the Morrow Group (Penn.), where conditions are good. An account is given of the stratigraphy of the area.

The Franks graben is triangular, with the apex towards the W. It is bounded on the N. by the Stonewall fault and on the S. by the Franks fault. Small cross faults, striking N.E., have considerable horizontal displacement. The general structure of the graben is that of a tilted block dipping N.E. in pre-Atoka formations. The surface formations dip N. and N.W. The Fitts pool structure is a faulted anticline within the graben. Production is controlled by a major E.–W. normal fault zone with a maximum throw of 1700 ft. and by associated cross faults striking N.E. The water level on the N. side of the pool is relatively uniform, whereas on the S. side it is disturbed by faulting.

The basal McLish sand has an average productive thickness of 40 ft. The upper McLish and the Bromide and Viola formations have a total normal thickness of 775 ft., and are expected to yield 60,000 brls. per acre. The basal McLish should yield considerably more than this. Productions varying from 25 to 200 brls. per day are obtained from an average thickness of 30 ft. in the Hunton formation. Estimates of production are difficult in the case of the Atoka sands, on account of lenticularity. They have large gas reserves, and locally they produce oil. The probable ultimate recovery from the field is estimated to be of the order of 100 million brls. Bottom-hole pressures in the Ordovician sands are approximately 1400 lb./sq. in. and show an average decline of 30 lb./sq. in. per month. S. E. C.

553.982(794)

1113. Recent Discoveries and Present Oil Supply in California. H. W. Hoots. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 939–950.—Discoveries during 1935, although not large, include gas-fields, oil-fields, and deeper horizons in one field. The new gas-fields are Semitropic and Tracy, and the new oil-fields are Tejon Ranch, Bartolo (E. Montebello), and El Segundo. In spite of much activity, Shiells Canyon is the only field in which a deeper productive horizon was found during 1935. Particulars of these discoveries are given, and it is estimated that they add less than 10½ million brls. to California's supply. This is less than 20 days' demand.

It has been estimated that at the beginning of 1935 California had a reserve of 3½ billion brls. recoverable by normal methods at the price then ruling. The rate of production, however, must also be considered, and it is pointed out that 60% of the state's production comes from pumping wells and 85% of the remainder comes from fields already 4–10 years old. The rate of discovery exceeded that of demand until 1931, but since then there has been a steady depletion of reserves. A committee established in January 1936 considers that a daily production of 670,000 brls. is possible during 1936, and that natural decline would probably then commence. Curtailment of production to 535,000 brls. daily during the remainder of 1936 and no excessive production during 1937 should extend the period during which a daily production of 600,000 brls. may be maintained until the end of 1938. After that date, unless important new fields or deeper zones be discovered, rehabilitation of old wells will be necessary to maintain the requisite rate of production.

It is considered that there are probably deeper horizons to be found in several fields which might yield a total of 500 million brls. and so prolong a daily production of 550,000 brls. until 1943–45. It is also pointed out that in the past four years, during which the discovery of new fields has been so slow, geological work and wild-catting have been drastically curtailed. Renewed activity will be necessary in order to discover hidden fields that unquestionably exist. S. E. C.

553.982(794)

1114. California Reserves. B. Mills. *Oil Weekly*, 7.9.36, **82** (13), 30–32.—California has produced about four and a half thousand million brls. of oil since 1876, of which three thousand million brls. dates from July 1, 1922. She will produce far less than 4,500,000,000 brls. during the next 20 years. During the last 8 years discoveries of new supplies have fallen short of actual requirements. This does not mean that a serious oil shortage is impending in California. Two periods in this State's oil history

occurred when the crude oil from its own fields fell short of the local and Pacific Coast needs, but new discoveries arrived in time to supply the deficiencies.

Unknown reserves cannot be estimated, but the author does not believe that any field as good as Kettleman Hills or as Long Beach is likely to be found in California, or that Ventura Avenue or the Shallow Midway Sunset will be repeated. San Joaquin Valley is vast both in extent and in possibilities, but will take a long time to develop. Four classifications are ordinarily considered in arriving at the amount of oil in any producing district. (1) Old zones in the process of development, (2) known deeper zones not developed; (3) new undeveloped fields; (4) unknown reserves as yet undiscovered. No. 4 is perhaps the most important, as it would be difficult for any but over-sanguine unscientific oil-men to anticipate by prediction the existence of such big fields as Long Beach or Kettleman Hills in California. Almost every big discovery or series of discoveries of large fields has been succeeded by a period of scarcity in new fields, and between 1929 and 1936 scarcely any big fields have been found in California. The importance of the recent San Joaquin Valley discovery is not yet gauged, but this great flat valley area is practically untested up to date, and its possibilities are inestimable. It has been generally thought that the past development along the edge areas covered the most promising areas, since surface indications of structural trends could be found there, and that production would be too deep for development in the flat area comprising the middle of this basin. Deposits in the untested districts are, however, not so thick or so favourable as those along the W. side of the valley. In the last 8 years wildcatting declined considerably, partly due to the major companies stopping exploration for new fields, and partly to the small operators not being able to do extensive wildcatting. Furthermore, production for a time could supply almost twice the amount of current requirements. Since January 1, 1929, California has produced 1,555,000,000 brls. of oil, but discoveries do not balance production during that period.

It is held by many geologists that the most accessible areas will probably yield nothing of great importance, since nearly all known structures in the principal producing districts have been tested. Due to the improvement in geophysical prospecting having begun to show results where the original work of this type was disappointing, a new school of thought has arisen, and recent geophysical work in the San Joaquin Valley has changed California's oil map. During the next few years the bed of this valley will be a centre of activity. The average discovery depth has increased recently, but the deeper fields show a higher reserve value. 3,500,000,000 brls. is the estimate of California's known reserves, but for practical purposes a much lower figure should be taken. A large percentage is represented by oil unsuitable for modern needs. Some of the Californian light oil does not refine satisfactorily, and yields a gasoline with a very low octane rating.

Most prolific fields of the past, such as Long Beach, Santa Fe Springs, Huntington Beach, *etc.*, will not yield in the future as much as they gave in the past. The author concludes by saying that California definitely needs a greater Reserve than it now has in sight. Recent discoveries have been promising, but other and greater fields will be required to balance supply and demand and to place the State in a strong position after 1938. B. F. N. M.

Geophysics.

550.83(498)

1115. Wildcat Drilling Campaign in Rumanian Plains Area. Anon. *Petr. Times*, 1936, **36**, 309.—Geophysical work of the last few years has led to the indications of areas worth testing in the Rumanian Plains, and many Companies have been waiting on the State to grant exploration perimeters to them. The rapidly increasing production of Bucsani under unusually active development created great optimism which has lately been somewhat dimmed since Bucsani has now probably attained its peak production with about 740 cars a day and Margineni, the latest structure to be tested, has, so far, disappointed expectations. Margineni is about 13 km. N.E. of Bucsani and 9 km. S.E. of Moreni. 7 wells drilled this year on this dome have given only some wet gas in the Meotic sands and a 35-ton well from a sandy streak in the underlying Miocene. A well at Brazi, 10 km. S. of Ploesti, reaching to the base of the Meotic, also has been discouraging up to date.

As a result of pressure by the Companies, the Government has issued a plan dividing the plains area of Dambovita and Prahova into blocks of 4000 ha. each in area, and certain Companies are given the right to select exploration perimeters of 1000 ha. The larger Companies have filed applications which will mean that at least eight rectangles of 4000 ha. will have test-wells drilling on them after the applications have been granted. A map is given showing the positions of 9 areas being tested or likely to be tested as follows:—Suta Seaca, Bucsani, Margineni, Ditesti, Manesti, Buda, Brazi, Bucov and Ploperi.

The gravimetric and electric methods used in Rumania have so far been failures in finding any deep-seated Meotic domes. The seismographic method has only recently been tried, and the efficiency of its determinations has not yet had a chance of proof or disproof. If what is predicted at Manesti is fulfilled, it will establish the seismograph method as being adaptable to the Rumanian conditions.

The failures up to date show that the mere finding of sub-surface "highs" under the Plains gravels is not enough to bring in productive fields: something more definite as to the cause of the structure and the nature of the strata is required.

B. F. N. M.

550.831

1116. A 42-Day Comparison of Four Vertical Variometers of the Knife-Edge Type. G. Hartnell. *Terrestrial Magnetism*, March 1936, **41** (1), 65–73.—From April 25 to June 5, 1935, 4 Z variometers, all having the knife-edge type of suspension, were in simultaneous operation, and this paper sets out to show what can be expected from Z variometers of this type carefully designed and constructed and operated under favourable conditions. Their relative performance was decided by comparing the ordinates for 4 periods of 1 hour/day. Variometers of this type, if of superior workmanship, can be operated satisfactorily for observatory purposes if kept free from mechanical jars and if the supporting surfaces are kept clean. B. F. N. M.

550.834

1117. Notes on the Block Structure of the Earth's Crust. N. Mizabe. *Scientia*, 1936, **59**, 15–19.—This article opens with a description of the study of the modes of actual deformation of the earth's crust at the present time. A series of retriangulations and re-levellings in various regions of Japan have been made recently in order to measure the deformation of the earth's crust, especially associated with destructive earthquakes. Analysis of the data of horizontal and vertical earth movements clearly shows deformations of the earth's crust, especially block movements. The horizontal movements are very difficult to determine, being the result of rotational deformation. Block movements are more clearly shown in curves—though some have to be indicated by straight lines—which show the vertical displacements of the bench marks. In 2 figures the author shows these vertical displacements, and from them concludes that the earth's crust was found to be composed of a number of blocks, the horizontal dimensions of which range from 10 to 50 km. in linear measurement with occasional smaller blocks of 2–3 km. The thickness of the blocks has not been measured by direct methods, but is estimated by experiment to equal the horizontal dimensions. The prevalent opinion has regarded the earth's crust as a whole to be an elastic body susceptible to the influence of seismic waves, whose velocities are thus expressed in terms of elastic constants of the earth's crust. Seismology, however, shows the earth's crust to be composed of several horizontal layers in which the velocities of seismic waves differ one from the other. Three such layers have been proved in the Kwanto district:

No.	Depth.	Dilational Wave Velocity.	Distortional Wave Velocity.
1	0–20 km.	5·0 km./sec.	3·15 km./sec.
2	20–50 km.	6·1 km./sec.	3·7 km./sec.
3	50 km.	7·5 km./sec.	4·45 km./sec.

Poisson's ratio σ of each layer is calculated as (1) 0·17 σ, (2) 0·21 σ, (3) 0·23 σ. It is suggested that the block structure is apparent only in the upper layers (granitic layers) of the earth's crust.

The author is of opinion that the sial or granitic layer differs from the sima or basaltic layer not only in its composition, density, etc., but also in its physical structure, *i.e.* the former is composed of a number of blocks, while the latter seems to be homogeneous.

B. F. N. M.

550.838

1118. Geomagnetic Co-ordinates for the Whole Earth. A. G. McNish. *Terrestrial Magnetism*, March 1936, **41** (1), 37–43.—The author, in the course of a recent investigation, constructed a system of geomagnetic co-ordinates, covering the entire earth. As they may be useful for finding the geomagnetic co-ordinates of various places, the nomographs prepared are reproduced to aid those engaged in geophysical researches. 4 charts, 1 table and a figure (key of sectors to charts) are given, together with instructions for using the nomographs.

B. F. N. M.

1119. Patents on Geophysics. 550.831 : 608.3

Apparatus for Determining Sub-Surface Tectonics of the Earth. J. C. Karcher. U.S.P. 2,044,079, 16.6.36.—This invention particularly refers to apparatus for determining the difference in force of gravity between two points on or near the surface of the earth. The principal object of the invention is to provide, through the medium of a plurality of electrical current balances, means for determining the difference in the gravitational constant between a plurality of points on or near the surface of the earth and through the medium of which valuable deposits of minerals, oil and gas may be discovered. The invention makes use of the Kelvin balance as described in the *Dictionary of Physics* (Vol. II, p. 3) except for some slight modification. One Kelvin balance, by itself, cannot accomplish the object claimed for this invention, therefore the difficulty is overcome by the use of sets of two conventional Kelvin balances to which some coils have been added. 5 claims.

550.834 : 608.3

Method and Apparatus for Seismic Prospecting. L. W. Blau and L. Statham. U.S.P. 2,046,104, 30.6.36.—This invention specially concerns improvements in Seismic prospecting. It refers more particularly to an improved method and apparatus for cancelling out different waves, that is waves of different types and wave-lengths, for sufficient lengths of time to permit of the clear recording of reflections. In the prior art, while in many cases it has been possible to eliminate or at least reduce the intensity of the transverse waves, since they are low-frequency waves, yet, in some areas, the higher frequencies of the longitudinal waves are absorbed, leaving only the low-frequency components. Any device which will eliminate or reduce the low-frequency transverse waves will similarly affect the low-frequency components of the longitudinal waves. Hence, if in such cases, the high frequencies are absorbed, nothing, or very little, is left of the reflections, therefore transverse waves cannot be eliminated in such areas by mechanical, acoustical or electric filters.

This invention claims that it succeeds, by the introduction of a beam, made of suitable material, preferably iron, which rests upon the surface of the ground and upon which the seismograph rests, in cancelling out different waves, waves of different types and wave-lengths for short times, but yet for sufficiently long times to permit of the clear recording of reflections, so that the reflections are accurately recorded with the results that reliable depths of the different reflecting layers are attained. This amounts to the collection for each seismograph of all the energy arriving by different paths from the source, over an area defined by the length and width of the beam. The amount of energy which is received and recorded by the seismograph is increased. One or a plurality of units can be used. A unit consists of a beam and its supported seismograph. Though the invention has been described as making possible the recording of reflections in those areas where the high-frequency components of the reflections are absorbed, while travelling from the source of disturbance to the seismograph, yet the invention is not limited in the scope of its application to such

areas, but will always result in great improvement of the reflection seismograph. 17 claims.

550.837 : 608.3

Ground Impedance Measurement. G. Wascheck. U.S.P. 2,046,436, 7.7.36.—This invention relates to the measurement of the mutual impedance of earth return circuits and more particularly to methods of an apparatus for measuring earth resistivity. It also has application to the determination of the contour of sub-strata of the earth and particularly to the location of oil and mineral deposits by what is commonly known as the earth resistivity method. As an improvement on the prior art, an object of this invention is to provide an earth resistivity-measuring system in which stray earth and polarization potentials are completely and automatically neutralized at all times. Another object is to obviate the introduction of the commutator factors into the mathematical computations. A subsidiary object is to reduce commutator sparking and the effect on the measurements of this and other transient disturbances. Another object is to provide an alternating-current system for measuring earth resistivity and means for determining the phase angle between primary circuit current and secondary circuit voltage. A feature of the invention is a device introducing in the secondary circuit a voltage that is periodically and automatically adjusted to effect complete neutralization of stray earth potentials and other voltage disturbances. In one specific embodiment the adjustment of the neutralizing voltage is effected by applying the disturbing voltage to a control device at periodic intervals between pulses of the primary circuit current. 10 claims.

550.834 : 608.3

Method of Making Geophysical Explorations. H. R. Prescott and F. L. Searey. U.S.P. 2,046,843, 7.7.36.—This invention more particularly refers to a means and method of determining the exact instant of detonation, that is the exact instant of the origin of the elastic wave. In the prior art the explosive charge is customarily detonated electrically by a blasting cap, usually comprising a filament which contacts fulminate of mercury (or a similar chemical) whose ignition temperature is about 200° C. An appreciable time interval must occur before this temperature is reached. Electric blasting caps also are not uniform, due to conditions in the construction of the caps. The condition of the cap is variable. The voltages employed and the resistance of the circuit are also variables. The inaccuracies introduced by assuming the instant the firing key is closed as the time of origin of the elastic waves has been recognized. One object of this invention is to provide a simple means for determining the exact instant of the blast of the primer, *i.e.* the time of origin of the elastic waves. The claim is : " An electrical current for detonating an explosive charge in the making of geophysical explorations, comprising a bridge wire of a detonator, a source of potential and a resistance connected in series; a shunt circuit for said resistance and means for recording fluctuation of current in said shunt circuit." 1 claim.

550.834 : 608.3

Method of Geological Exploration. H. R. Prescott and F. L. Searey. U.S.P. 2,049,724, 4.8.36.—This invention relates more particularly to a means and method for investigating the geological strata below the surface by using earth vibrations generated for that purpose. The seisphone will receive low-frequency vibrations generated and transmitted in the geological layers near the surface of the earth, also a group of intermediate frequency vibrations reflected or caused in the underlying geological layers, and furthermore the high-frequency vibrations due to wind, to the natural unrest of the earth and to extraneous vibrations. The result is that frequently the various vibrations are so commingled and confused that no accurate results can be obtained by a reading of the record of the seisphone vibrations. One object of this invention is to provide a method in which, substantially, only the useful and desirable intermediate frequency vibrations which are transmitted from the underlying geological strata are recorded. Another object is to provide a means for rejecting the undesirable low and high frequencies which are picked up by the seisphone and recording only the useful intermediate frequencies. By this invention it is claimed that by the use of the low-pass filter undesirable high frequencies are eliminated, by

the use of the high-pass filter the low frequencies are eliminated. The high-frequency adjustment is substantially independent of the low-frequency adjustment, and an adjustment may be made to operate each. It is claimed that not only is this method an improvement over the known methods but it enables explorations to be made in certain areas where the known methods could not be used, as in many areas of loose sand, unconsolidated soil or river deposits on the surface. 4 claims. B. F. N. M.

Drilling.

622.24

1120. Cost of Drilling. H. A. Harris. *J.I.P.T.*, 1936, **22**, 562–576.—A paper, with discussion, at the Trinidad branch on a costing system suitable for assessing well costs and production expenses. G. R. N.

622.24

1121. Louisiana Leads World in Deep Drilling. C. Leyendecker. *Oil Weekly*, 7.9.36, **82** (13), 45–50.—This article claims that 7 tests on the Louisiana Gulf Coast have drilled below 10,000 ft. in the past year and a half, and that this area is the leader of deep producing and drilling regions of the world. These 7 tests represent about one-third of all such wells in the world. The deepest Louisiana well reached 11,505 ft. in August, plugged back because of a crooked hole and is now drilling in a new hole at 11,100 ft. There are 7 wells in the world now at 11,000 ft. or deeper, 1 in Louisiana, 2 each in Texas and in California, 1 in Oklahoma and 1 in Rumania. Leading geologists believe that oil will be found below 20,000 ft. The lowest pay horizon in the world is from about 9740 to 9840 ft., in the Ventura field, California. A good paying well in the Lafitte field, Louisiana, is 9640 ft. deep. The deepest producing well is in Caddo County, Oklahoma, which is gas-lifting 50 brl. daily, but is not considered of commercial value. The Louisiana Gulf Coast has begun to drill 10,000 ft. wells as a matter of course, not as an exception. In the search for new oil reserves geophysical companies and departments keep up with the deep drilling and begin shooting for structures 2000–4000 ft. deeper than the drill has reached. It is expected that drilling to and producing from 10,000 ft. deep or deeper may be necessary in order to get future reserves. B. F. N. M.

622.24

1122. Deepest Well on Gulf Coast Completed without Trouble. N. Williams. *Oil & Gas J.*, 23.7.36, **35** (10), 27.—The longest, but not the heaviest, string of casing in the world has just been run and cemented in the Louisiana area. The string of 7-inch O.D. pipe was 10,947 feet long. Several other records were put up by this well, as it is the deepest test drilled on the Gulf Coast, and also the open hole carried before running the record string was the greatest on record, being 9075 feet. L. V. W. C.

622.24.051.42

1123. Cable Tool Coring in Flooding Operations. E. A. Guenter. *Petr. Eng.*, July 1936, **7** (11), 62.—The practical aspects of cable tool coring together with some of the important points to be considered for obtaining good cores are described. L. V. W. C.

622.24.051.42

1124. Cable Tool Coring in Mid-Continent and Texas Fields. W. A. Sawdon. *Petr. Eng.*, August 1936, **7** (12), 74.—A number of rules have been formulated to enable maximum efficiency to be obtained from a cable tool core barrel. These rules have resulted from the experience gained during the operation of the tool in the Mid-Continent and Texas fields.

The hole must be in the best condition, bailed clean and free from iron, and the hole must be sufficiently full of fluid to cover the tools.

Progress will be about 10% slower with the cable tool core barrel than with straight drilling. L. V. W. C.

622.242.2

1125. Rig Water System. F. B. Taylor. *Oil Weekly*, 20.7.36, **82** (6), 28.—An automatically-controlled single-boiler water system has shown a minimum water saving of 80% over the customary arrangement.

Attached to the side of the boiler is a water level control which automatically actuates the boiler feed pump through an enclosed lift. This lift opens orifices allowing steam to add make-up water.

After the steam has been used for engine operation it is condensed in an upright header and is then returned to the wooden make-up tank.

Back pressure on the exhaust is prevented by discharging condensed water from the rising steam by means of a water leg. L. V. W. C.

622.243.14

1126. Drilling-in Wells in the Oklahoma City Field under Controlled Pressure. K. C. Sclater. *Petr. Eng.*, August 1936, **7** (12), 36.—Pressure changes in the reservoir in the Oklahoma City pool have influenced the methods of drilling-in and completing wells. The large drop in pressure which occurred between the drilling of the first well in the south end of the pool and the discovery of the Mansion Area caused a change in the drilling-in methods. The heavy drilling muds previously used penetrated the productive sand, preventing the wells from flowing naturally. Thus all wells in the Mansion Area have been drilled-in under controlled pressure.

The pressure carried in the circulating system at the bottom of the hole is controlled by using a light drilling fluid which exerts a pressure less than that in the producing formations. The drilling fluid is composed of gas and oil, and before it is pumped into the hole the hole is cleared of mud and water. The actual quantities of gas and oil to be used will depend on the conditions. L. V. W. C.

622.243.3

1127. Protecting Oil-Sands by Directional Drilling. A. Anderson and T. K. Sawyer. *Petr. Eng.*, August 1936, **7** (12), 36.—In a well in the Edison field, California, a high-pressure water-sand was passed through between 1750 ft. and 2700 ft. It was decided to set 8¼-in. casing above the 1750 ft. level with a blank liner cemented opposite the intermediate water-sand. A cement bridge about 100 ft. in length was placed in the hole above the top of the upper sand at 1750 ft., and when drilling ahead with a 7¼-in. bit it was found that the bridge had acted as a whipstock and had diverted the hole to such an extent that the originally drilled 10¾-in. hole was completely sidetracked. The new hole was, therefore, plugged and a deflecting tool was used to force the hole back into the original direction. The new hole broke into the original hole after drilling to 1982 ft. L. V. W. C.

622.243.3

1128. Application of Directional Drilling. D. S. Sneigr. *Oil Weekly*, 27.7.36, **82** (7), 22.—Directional drilling is occupying a position of increasing importance because it is an economic factor from the standpoint of time and expense. Among the important uses to which directed drilling is applied may be quoted, sidetracking junk in a hole, straightening crooked holes, deflecting wells across faults and drilling to completely miss overhanging salt-domes.

The use of whipstocks to deflect new holes is probably the most important method yet developed.

The drilling of relief wells to kill cratered or burning wells illustrates the accuracy of directional drilling. Mining engineers have taken advantage of this method in geological exploration work. L. V. W. C.

622.243.5

1129. Truck-Mounted Rotary. J. C. Albright. *Oil Weekly*, 6.7.36, **82** (4), 38.—A light portable-type of rotary drilling rig which has the unusual features of being completely and permanently mounted on the chassis of a heavy-duty truck is being used successfully in drilling shallow holes. A vertical multi-cylinder gas/gasoline engine is an integral part of the drilling unit, being placed upon a sub-frame that also

supports the draw-works and other equipment. The truck motor operates the slush pump independently of the vertical drilling engine. L. V. W. C.

622.243.5

1130. Modern Steam Rig. D. S. Sneigr. *Oil Weekly*, 10.8.36, **82** (9), 27.—The steam rotary drilling rig recently assembled by J. Frazier on the Gulf Coast area embodies the latest mechanical improvements and principles, and although its initial cost was greater than with the normal rig, running and maintenance costs are much smaller. The rotary is operated by a separate vertical twin-steam engine thus enabling the draw-works to stand idle when drilling is in progress. Wear and tear on the main engine is thus eliminated. An important advantage in using this drilling unit is the ease and simplicity with which the drill-pipe can be pulled from the hole. Steam is saved by preheating the feed-water by means of the exhaust steam. Large-size sheaves are used and these have resulted in a great saving in wire line costs.

L. V. W. C.

622.245.14

1131. Gun Perforator Utilized for Completion of Oil Wells. T. P. Sanders. *Oil & Gas J.*, 23.7.36, **35** (10), 53.—In the Samfordyce field, Texas, an unusual method of setting the flow string is practised. By this method the pay is drilled with a core drill and reamed before running the flow string. This string is then cemented through the pay zone, and using the information obtained from the cores the casing is perforated by means of a gun at the depth thought to be most suitable.

L. V. W. C.

622.245.2

1132. Exact Cementing Operations required to Cast Off Upper Water. E. S. Post. *Oil Weekly*, 3.8.36, **82** (8), 46.—Revised cementing methods have become necessary to cut off the upper water in the Loma Novia and Hoffman districts of Duval County. A sand containing salt-water at nearly the same head as that found in the oil-sand is encountered immediately above the producing zone, separated from it by a thin shale stratum.

The general practice in the Loma Novia field is to drill a 9¼-in. hole to land 7-in. casing through the shale and to cement with 200 sacks of cement. After drilling out the plug and running liner the wells are brought in by swabbing, and on commencing to flow salt-water breaks in immediately in many cases. When water appears the common practice is to pull the liner and squeeze cement at the casing shoe. This trouble can be eliminated completely if the mud in the hole is put in the best possible condition before cementing. L. V. W. C.

622.245.33 : 622.243.414

1133. Use of Gel-Type Clay in Cable Tool Drilling. F. L. Swindell. *Oil Weekly*, 10.8.36, **82** (9), 35.—Gel-type clay has been successfully used in drilling cable tool tests to overcome many of the problems encountered. Where low-pressure water-sands are encountered between beds of hard material it may be necessary to set a string of casing. The use of gel-type clay has been advantageous. Sealing-off fresh-water sands from salt-water sands is another instance of its use.

Many other uses are described in the article. L. V. W. C.

622.245.2 : 608.3

1134. Patents on Drilling Equipment. J. T. Barkelew and H. E. Scantlebury. U.S.P. 2,043,979, 16.6.36. A well-cleaning device operated by a difference in pressure between a low-pressure container and the well pressure.

622.24.051.4 : 608.3

J. H. Howard. U.S.P. 2,044,303, 16.6.36. Well drilling bit.

622.24.051.4 : 608.3

W. L. Diehl. U.S.P. 2,044,349, 16.6.36. Hydraulic rotary drill.

622.24.051.4 : 608.3

F. L. Scott. U.S.P. 2,044,549, 16.6.36. Three-cutter bit.

622.24.051 : 608.3

H. F. Stevens. U.S.P. 2,044,648, 16.6.36. Sidewall formation sampler.

665.514 : 608.3

G. L. Hassler. U.S.P. 2,045,465, 23.6.36. An electrical method for breaking emulsions, and apparatus for carrying out such a method.

622.245.1 : 608.3

W. L. Bettis. U.S.P. 2,045,629, 30.6.36. Rubber well-casing protector.

622.245.62 : 608.3

E. E. Johnson. U.S.P. 2,046,456–2,046,461, 7.7.36. Well screens for oil wells, and the method of fabrication.

622.276.4 : 608.3

W. E. Patterson. U.S.P. 2,046,479, 7.7.36. Pump anchor for reciprocating pumps.

622.245.1 : 608.3

A. J. Penick and K. T. Penick. U.S.P. 2,046,579, 7.7.36. Tubing Head.

622.24.051.4 : 608.3

W. A. Abegg. U.S.P. 2,046,598, 7.7.36. Rotary disc bit.

622.245.14 : 608.3

R. S. Smith. U.S.P. 2,046,752, 7.7.36. Casing perforator.

622.245.62 : 608.3

A. Clasen and F. X. Scholtes. U.S.P. 2,046,870, 7.7.36. A method of repairing wells having sand points the outer wire screens of which are corroded.

622.243.7 : 608.3

T. L. Lynch and H. L. Rilling. U.S.P. 2,046,956, 7.7.36. An inclination-indicating device having a valve mounted on the drill-pipe, a rest and a gravity-actuated means for engaging the rest and to hold the valve in position, restricting flow of fluid through the drill-pipe within predetermined limits in the inclination of the pipe.

622.276.4 : 608.3

R. N. Vickers. U.S.P. 2,048,085, 21.7.36. Deep well pump.

622.245.2 : 608.3

J. T. Barkelew. U.S.P. 2,048,095, 21.7.36. Well-cleaning device operated by a difference in pressure between the outside and inside of the tool.

622.245.44 : 608.3

D. L. T. O'Connor. U.S.P. 2,048,136, 21.7.36. Well packer.

622.276.4 : 608.3

E. O. Bennett. U.S.P. 2,048,320, 21.7.36. Pumping-rod assembly having a stuffing box and a bearing sleeve for rod to co-operate with stuffing box to form a sealing and wearing surface.

622.245.15 : 608.3

J. R. Yancey. U.S.P. 2,048,530, 21.7.36. Inside pipe cutter having a plurality of cutters operated by mandrel.

L. V. W. C.

Production.

622.245.563

1135. Present Status and Future Possibilities of Acid Treatment in Illinois Fields. F. Squires. *Petr. Eng.*, August 1936, **7** (12), 40–42.—The simplicity of every successful method of increasing oil production allows the description of each by one word: shooting, suction, repressuring, flooding and acidizing. The last named is only useful on limestone or on calcareous sandstone. Its recent success makes acidizing worth research on (1) the limits of its successful application to rocks partly sand and partly lime, (2) improvement of the technique of application, (3) other oil-field uses of acid, and (4) the actual effects of acid on the oil-producing lime. The author describes a little of what has already been done and propounds his ideas of further applications of the process. The article concludes by pointing out that acidizing has been successfully used in Illinois and that a considerable field for extension remains, such as investigation along the lines of heat treatment, agitation, side-wall coring, fishing, vertical and horizontal drilling and a field-size experiment at some outcrop of oil-bearing limestone. B. F. N. M.

622.245.563

1136. Preparation of Wells for Acid Treatment. B. M. Kingston. *Oil Weekly*, 3.8.36, **82** (8), 45.—Before a well can be treated with acid it must be thoroughly cleaned, and this applies whether there is open hole or casing and tubing present.

Wells of high pressure will clean themselves but low-pressure wells must be cleaned with water to remove accumulated sludge.

The hole should be free of fluid. Casing strings should be set close to the producing formation and the casing seal should be cemented.

Before treatment of hard compact formations small shots of nitro-glycerine or other explosive are advisable. Cracks will be opened and allow the acid a larger area on which to start working. Shooting should be done before the casing is cemented, and all the usual means to protect the casing should be observed. L. V. W. C.

622.276

1137. Production Lifting Methods in California. W. A. Sawdon. *Oil Weekly*, 13.7.36, **82** (5), 65.—Consideration has already been given to the problem which will eventually arise when the 10,000 ft. and over wells will require to be pumped. The majority of the producing wells in the state of California are on the pump, and the individual pumping unit is very widely used.

Where gas under proper pressure is available from producing wells a number of wells may be put on gas-lift, but the number of wells in this state being produced in this manner is less than 2% of the total of producers.

Simpler but stronger fittings are now used to make up the Christmas tree, the assembly being tested up to 6000 lb./sq. in.

Flow control by manifold hook-up is standard practice; oil meters are more popular and well repair work and well servicing are now being widely done with portable equipment. L. V. W. C.

622.276

1138. Lowering Lifting Costs through Well Studies. F. B. Taylor. *Oil Weekly*, 13.7.36, **82** (5), 51.—The practice of taking dynamometer cards of pumping wells has resulted in much more efficient working, but these cards are not in themselves sufficient. Their indications must be co-ordinated with other data, such as the record of the well's production and operating speeds, the condition of its surface equipment, information as to size and type of material, data on fluid conditions and general lease experience. Thus a complete well study may include dynamometer cards, tachometer speed recordings, polar diagrams, service record of equipment, fluid studies, production records and a graphical trouble analysis.

A better understanding of the unknown factors will undoubtedly result from a co-ordination of dynamometer cards with field results. L. V. W. C.

622.276.4

1139. Oil Well Recording Dynamometer. J. G. Baker and H. C. Werner. *Petr. Eng.*, July 1936, **7** (9), 33.—The article describes the development of a load-recording apparatus which overcomes the normal objections as well as providing a practical means of recording the polished rod velocity. L. V. W. C.

622.276.4

1140. Pumping with Electric Power in Robbins Pool, Kansas. G. H. Weckel and R. E. Patrick. *Petr. Eng.*, August 1936, **7** (12), 33.—The authors discuss the flexibility and economy of purchased electric power as employed with modern equipment in the Robbins pool, Kansas, where changes in method of applying power by multiple well hook-ups are adopted as an economic measure to meet the declining productivity of the wells. L. V. W. C.

622.276.4

1141. Comparison of Beam and Rotary Counterbalances. E. N. Kemler. *Petr. Eng.*, July 1936, **7** (11), 75.—The author discusses the effect on peak rod load, on the shaking forces in foundations and on stresses in pumping equipment, using the results of beam and rotary counterbalancing with respect to reduction of peak power requirements. L. V. W. C.

622.276.4

1142. Studies of Repressuring and Water-Flooding. A. H. Bell. *Petr. Eng.*, August 1936, **7** (12), 60.—A knowledge of the presence of natural water floods, of the direction of fluid movement and of the pressure gradients together with such factors as the amount of oil remaining in the sand and the porosity, permeability and texture of the sand are imperative in any repressuring or water-flooding project. The last factors can all be obtained by coring. L. V. W. C.

622.276.4

1143. Water Flooding in Nowata District Showing Increase. P. Reed. *Oil & Gas J.*, 30.7.36, **35** (11), 66.—There has been a steady increase in water-flooding projects in Oklahoma during the past year and this period has been marked by a clearer appraisal of the factors to be reckoned with in flooding developments.

The problem of the supply of water for future operations is under discussion, and a dam is expected to be built to supply 300,000 brls. daily for use in the future when additional water will be required.

Treatment of waters for use in flooding projects is being studied. L. V. W. C.

622.276.95

1144. Air- and Gas-Lifts. B. Baklanov and R. Shishchenko. *For. Petr. Tech.*, 1936, **4**, 191–208.—A comprehensive hydro-dynamical treatment of the problem of air- and gas-lifts is given, the theory advanced corresponding to the basic principles established by oil-industry practice. This theory permits a quantitative evaluation of the losses in the relative movement through the lift tubes, thus making it possible to approach the proper selection of the diameter of the lift tubes, under various operating conditions. It also permits a qualitative evaluation of the main advantages of gas-lift as compared with air-lift. G. R. N.

622.276.95

1145. Compressor Plant of 4700 h.p. Capacity. S. F. Shaw. *Petr. Eng.*, July 1936, **7** (9), 24.—One of the largest compressor plants used exclusively for gas-lifting oil is in the Oklahoma City Field. It has 24 compressors aggregating about 4700 h.p. and consisting of 10–230 h.p. duplex two-stage compressors, 11–165 h.p. duplex two-stage compressors and three 190 h.p. three-stage compressors.

A full description of this plant is given. L. V. W. C.

622.279

1146. Reviving Production of a Nearly Exhausted German Field. W. Sack. *Oil Weekly*, 6.7.36, **82** (4), 19.—The exhausted sands of the Wietze-Steinfoerde oil-field of

Hanover have been revived by attacking the structure from below and draining the remaining oil from the sands by gravity.

With the co-operation of all leaseholders only one shaft was necessary and this to a depth of 700 ft. The freezing method was applied to keep back surface waters, and the frozen overburden was drilled and blasted out and the walls of the circular shaft were lined with concrete.

The shaft was completed within one year together with a station at the 350 ft. level. Two tunnels were then driven; one from the 350 ft. level in a S.E. direction and the other from the 700 ft. level in a N.W. direction. Cross-cuts were then driven underneath the oil-sands and a large sump dug at the ends of each in such a way that the whole structure was laid out in blocks 600 ft. wide.

Holes were then drilled into the oil-sand above and a steady flow of about 2 barrels per hour resulted with an average of about 250 barrels an hour for each 500 ft. of drilled cross-cut. L. V. W. C.

622.323 : 622.248.38

1147. Paraffin Deposits. Anon. *Oil Weekly*, 13.7.36, **82** (5), 83.—Paraffin troubles have been prevalent in the East Texas field but good production practices have reduced them to a minimum.

Since tubing kept full of oil has been less susceptible to paraffin accumulations it is believed that pumping wells when operated continuously will be less troubled than the average flowing well.

An oil–water emulsion increases the accumulations of paraffin, and water allowed to cool in the upper part of the tubing has accelerated the accumulation of paraffin in many wells.

Various methods have been used to remove paraffin deposits including scrapers, chemicals and less potent liquids such as gas-oil, with varying degrees of success. L. V. W. C.

622.323 : 622.248.38

1148. Removal of Scale. B. Mills. *Oil Weekly*, 13.7.36, **82** (5), 119.—The formation of scale in tubing, rods and pump parts is presenting a serious problem in the Mexia, Texas, district.

The accumulation, which prevents the successful operation of pumping wells, has been confined to the lower 250 ft. of the hole, and the formation of the scale under certain conditions indicates that temperature and the movement of the fluid in the hole affect the action of the minerals in the water.

The rate of accumulation has been steadily increasing and the formation of the scale has been so heavy that its removal has been difficult even after pulling the tubing.

The scale shows an abrasive and knife-like action that rapidly reduces ordinary cups to shreds. L. V. W. C.

622.323 : 66.069.84

1149. Lighting Tank Flares. E. Sterrett. *Oil Weekly*, 17.8.36, **82** (10), 26.—Igniting flares used to dispose of waste gases at tank batteries as the connected wells are being flowed is attended with considerable danger, especially where the gas is heavier than air and, therefore, tends to settle or flow downwards.

One company has arranged a simple hook-up to obviate any danger of this occurring. A tee is cut into the 2-in. line from the separator and a valve is placed in the riser with a ½-in. line from this valve to the bottom of the upturn on the riser.

With the master gate in the gas header still closed the switches open the valve on the ½-in. line riser and ignites the gas flowing. The master gate is then opened and once gas begins to come from the tanks the feeder line from the separator is closed off. L. V. W. C.

622.323 : 665.514 : 681.121

1150. Simple Installation to Meter Disposal Water. J. C. Albright. *Oil Weekly*, 10.8.36, **82** (9), 58.—The water volume in the emulsion from the Santa Fe Springs field of the Union Oil Company is checked by a simple but efficient means.

The oil is treated by steaming, heating and the use of some treating compound. The water is separated by more or less conventional methods and is then passed through a weir box to which is attached an ordinary differential meter recorder. By this means it is possible for the amount as well as time involved to be measured.
L. V. W. C.

622.324.5

1151. **Characteristics of Natural Gas Wells.** M. A. Schellhardt and E. L. Rawlins. *Oil Weekly*, 20.7.36, **82** (6), 32; 27.7.36, **82** (7), 25.—Periodic back-pressure tests have been made by the Bureau of Mines on numerous gas wells in the Texas Panhandle field to study the delivery capacities of the wells under different pressure and operating conditions and to determine the relationship between pressures and rates of delivery from gas wells.

This article covers the fundamental intake characteristics of natural gas wells, and a method for determining intake capacities under different well-head pressures from data descriptive of the " output " characteristics of the wells has been developed.
L. V. W. C.

622.324.5

1152. **Characteristics of Natural Gas Wells.** M. A. Schellhardt and E. L. Rawlins. Part III. *Oil Weekly*, 3.8.36, **82** (8), 38.—In this article the output and intake characteristics of the gas wells tested are shown graphically by plotting rates of gas delivery against corresponding values of pressure factors, output and intake characteristics. L. V. W. C.

622.324.5

1153. **Conservation of Gas.** E. O. Buck. *Oil Weekly*, 6.7.36, **82** (4), 30.—A more thorough study of all producing conditions in each new field followed by the adoption of a properly engineered co-operative programme among operators to conserve the available gas energy in the reservoir will result in a minimization of gas wastage and a correction of wasteful producing practices. L. V. W. C.

Pipe-Lines and Transport.

622.324.5 : 622.698

1154. **Gas Gathering and Fuel Distribution Systems.** R. L. Huntington. *Oil Weekly*, 6.7.36, **82** (4), 24.—The author deals with the gas gathering and fuel distribution systems, which are important adjuncts to natural gasoline plants. He discusses the raw gas truck lines, the relationship between sizes of the suction and discharge lines, increasing the gas handling capacity of a compressor station, large lines *versus* small lines, and a number of other points of interest to pipe-line engineers. L. V. W. C.

622.324.5 : 681.121

1155. **Gas Delivery Chart.** C. J. Brown. *Oil Weekly*, 3.8.36, **82** (8), 36.—This is a description of an orifice meter delivery chart which is designed to facilitate the solution of various problems found in connection with the delivery of gas. L. V. W. C.

Storage.

662.753.1 : 656.073.27

1156. **Hazards Involved in the Storing of Natural Gasoline.** G. W. McCullough. *Oil & Gas J.*, 23.7.36, **35** (10), 38.—Development of special steel containers, spheres and spheroids for 26 lb. R.V.P. gasoline and vertical cylinders, with spherical top and bottom, for butane and propane is outlined. Recommendations in regard to spacing of tanks vary, but adequate fire wall capacity should be provided around each tank to confine the liquid in case of connection leaks and breakages. Installation of vapour-collecting and recovery systems and of vents and flame arresters has materially reduced fire hazards. Location of tankage should be carefully chosen in relation

to other plant, buildings, etc., bearing in mind prevailing wind. It is important that, should leakage occur or vapours be released, there should be no direct downward flow towards open fires. Examples of serious fire resulting from flow of vapours to boiler-houses, etc., several hundred feet away, followed by burning back to the storage tanks, are given. An advantage of underground storage is the ability to confine leakage or subsequent fires to the individual battery. Prolonged cold and prolonged rain have caused breakage of tank connection where tanks were erected on concrete piers. Swing connections are recommended for overcoming such expansion and contraction troubles on small tanks, and steel gates flanged directly to nozzles riveted or welded to the tank in the case of large tanks. Anti-freeze drains are recommended to avoid freezing and bursting of drain connections. Use of anti-corrosive materials for gauges, relief valves and vents is advantageous, but careful periodical inspection of such parts is essential. Recommendations to ensure adequacy of relief valves are made. Blending tanks should have submerged inlets to avoid static charges due to falling streams of liquid. When handling corrosive natural gasolines the effects of corrosion must be taken into account when building storage, and special precautions observed when cleaning tanks, owing to presence of pyrophoric iron sulphide. Sufficient steam must be injected into any tank continuously when the steaming operation is once started to prevent cooling, condensation and possible inrush of air into the tank allowing formation of combustible mixtures. R. A. E.

665.521.2 : 656.073.27

1157. Petroleum Spirit Dangers. Anon. *Chem. Trade J.*, 11.9.36, **99**, 213.—The report of H.M. Inspector of Explosives for 1935 discusses the 63 accidents in connection with petroleum spirit which occurred in that year. One of the accidents was attributed to the glowing of iron sulphide on the underside of a tank roof. The possibility of the production of H_2S by bacterial action is discussed, this question being now under investigation by the D.S.I.R. in collaboration with the oil companies. Four accidents occurred during the filling of storage tanks due to insufficient tightness in the joint between the delivery hose and the fill-pipe. A circular issued by the Explosives Dept. calls attention to the dangerous practice of removing the caps of dip-pipes when replenishing storage tanks in order to hasten delivery rates. C. L. G.

Chemistry of Petroleum.

547.2

1158. Effect of Oxygen on the Reaction between Bromine and Butadiene. G. B. Heisig and H. M. Davis. *J.A.C.S.*, 1936, **58**, 1095–97.—This paper describes the reaction between equimolar mixtures of butadiene and bromine in the presence of, and absence of oxygen. The oxygen partial pressure was 2 mm. in one series of experiments and 375 mm. in another, the total pressure in each case being one atmosphere. The reaction rate was found to increase with decrease in oxygen concentration. This increase was especially noticeable when the partial pressure of oxygen was well below 2 mm. The evidence that the reaction occurs largely at the surface suggests a chain mechanism with short chains initiated at the surface, and broken by the oxygen. The authors point out, however, that the data do not exclude a mechanism in which reaction occurs wholly at the surface and the rate decreases when "active centres" are occupied by oxygen. W. E. J. B.

547.314.2 + 547.212

1159. An Azeotropic Mixture of Acetylene and Ethane at Atmospheric Pressure. W. A. McMillan. *J.A.C.S.*, 1936, **58**, 1345.—Mixtures of pure acetylene and ethane were made by blending in the gas phase in an all-glass evacuated system. The mixtures were then condensed and distilled through a special low-temperature fractionating column. Determinations carried out over the pressure range 752–766 mm. gave the following data for the azeotropic mixture: Boiling point $-94{\cdot}5 \pm 0{\cdot}1°$ C. Composition: acetylene $40{\cdot}75 \pm 0{\cdot}25\%$, ethane $59{\cdot}25 \pm 0{\cdot}25\%$. The recognition of this mixture explains some apparent discrepancies noted by other workers. W. E. J. B.

Physics of Petroleum.

536.7

1160. The Hydrocal. A. D. Moore. *Ind. Eng. Chem.*, 1936, **28** (6), 704.—The temperatures occurring in a body during cooling or heating are the result of temperature gradient, thermal conductivity and heat capacity. An exact hydrodynamic analogy exists, in which the first property corresponds to pressure head, the second to resistance to flow and the third to capacity.

The mathematical solution of the transient heat problem is difficult and extremely laborious. By using the hydrodynamic parallel it is possible to construct an apparatus which will allow a solution to be obtained in the space of a few minutes. Examples of two such instruments are fully described. P. D.

546.22—1

1161. Thermal Constants of Sulphur Dioxide. Anon. *Chem. Trade J.*, 11.9.36, **99**, 210.—According to a report of Dr. A. Perlick to the Deutsche Kältverein, sulphur dioxide possesses the following thermal properties: *Gaseous* SO_2. Heat of evaporation at − 20° C., 98·0; at 0° C., 98·6; and at 20° C., 88·2 K.cal./kg. *Liquid* SO_2. Spec. heat between m.pt. (− 75·27° C.) and 20° C., 0·333 K.cal./kg./° C. *Solid* SO_2. Heat of fusion 27·9 K.cal./kg.; specific heat at − 172·9° C., 0·1810 and at − 78·5° C., 0·2555 K.cal./kg./° C. C. L. G.

547.2 : 535.342

1162. Absorption and Fluorescent Spectra of Hydrocarbons with several Benzene Nuclei. R. Titeica. *Ann. des Comb. Liq.*, 1936, **11**, 445–470.—The study of the absorption spectra has been made using Hilger E.31 and E.1 spectrographs, whilst the former was used for the study of fluorescence. The hydrocarbons were examined in solution in ethyl alcohol, whilst some were also examined in hexane. Hydrocarbons investigated were benzene, toluene, ethyl benzene, di-phenyl methane, benzyl naphthalene, naphthalene, α-methyl naphthalene, di-phenyl, stilbene, di-methyl stilbene, phenanthrene, chrysene, pyrene and fluorene. Some general conclusions of the author are that the fluorescent spectra lead themselves more readily to interpretation and study than do the absorption spectra. The latter, in some cases, are very complex. Substances with benzene nuclei have absorption spectra in the near ultra violet (2400–3800 Å.). These spectra are composed generally of distinct bands. When the molecule also contains double bonds of aromatic or aliphatic type, or when several benzene nuclei are conjoined the absorption bands become large with ill-defined maxima. In general, the same remarks apply to the fluorescence spectra. The spectra can serve to identify the presence of molecules which would offer serious difficulty if a chemical identification were attempted. W. E. J. B.

547.211 : 665.51

1163. Phase Equilibria in Hydrocarbon Systems. XV.—Mixtures of Methane and a Crude Oil. B. H. Sage, D. C. Webster and W. N. Lacey. *Ind. Eng. Chem.*, 1936, **28**, 984.—Specific volumes and specific heats of several mixtures of methane and a crude oil were determined over the temperature range 75–225° F., pressure range 0–3000 lb./sq. in. A Californian crude was used, and an analysis is given. Mixtures containing up to 10% by weight of methane were used, but it was found that addition of a further quantity of methane caused a separation into two liquid layers. P. D.

547.214 : 539.411

1164. Compressibility of Butane–Air Mixtures below One Atmosphere. F. W. Jensen and J. H. Lightfoot. *Ind. Eng. Chem.*, 1936, **28**, 810.—The compressibility of *n*-butane–air mixtures was determined at 30° C. It is shown that the additive rule for determining the compressibility of gas mixtures at low pressure does not hold, the maximum deviation being 23%. The variation of the compressibility coefficient of *n*-butane with temperature is presented. P. D.

547.214 + 547.215

1165. Phase Equilibria in Hydrocarbon Systems. XIV.—Joule-Thomson Coefficients of *n*-Butane and *n*-Pentane. E. R. Kennedy, B. H. Sage and W. N. Lacey. *Ind. Eng. Chem.*, 1936, **28**, 718.—The Joule-Thomson coefficients of *n*-butane and *n*-pentane were determined over a temperature range 70–220° F. using the apparatus and method previously described (*Ind. Eng. Chem.*, **27**, 1484). The figures for these two vapours and for propane are compared on a reduced temperature–pressure basis. Butane and pentane correlate well, but propane shows some divergence, which is to be expected for a compound near the beginning of a homologous series. The values for the specific heat at constant pressure and for the isothermal change of heat content with change of pressure are calculated from the experimental results, and are presented graphically. P. D.

Analysis and Testing.

543.71

1166. Cleaning of Copper Strips. E. G. Ivanova. *Neft*, 1936, **6**, 21–22.—Satisfactory results were obtained by cleaning copper strips used in the corrosion determinations on petroleum products by treating them with a 5% solution of NH_4OH, followed by neutralization with oxalic acid. For. Petr. Techn.

545.727

1167. Hydrogen Value as a Means for Measuring Unsaturation. W. J. C. de Kok, H. I. Waterman and H. A. van Westen. *J.S.C.I.*, 1936, **55**, 225T–228T.—Halogen addition methods are not entirely satisfactory for measuring unsaturation. A method is described in which a known weight of substance and known volume of hydrogen are brought into contact with a platinum or palladium catalyst. After hydrogenation is complete, the excess hydrogen is measured and the hydrogen absorbed calculated. It is claimed that hydrogen addition gives a true measure of unsaturation, side reactions such as substitution cannot occur and the hydrogenated product can be isolated quantitatively. C. C.

Gas.

532.522

1168. Nomograph for the Solution of Problems on the Operation of Natural Gas Plants. J. L. Thompson. *Nat. Petr. News*, 22.7.36, **28** (30), 27.—A chart is presented for the solution of the equations involved by considerations of the flow of gases and liquids through orifices. H. G.

662.69

1169. Utilization of Natural Gas Fuel for Central Stations. E. F. E. Schmidt, *Oil & Gas J.*, 23.7.36, **35** (10), 47.—In the South-West approx. 78% of the entire fuel requirements of central power stations are supplied by natural gas. Large resources of gas have permitted piping of gas to other states in the Mid-West, etc. In assessing the value of natural gas as fuel, it must be remembered that stored fuel and storage equipment are not required. Other advantages over solid and liquid fuels are enumerated. It is usual to have boilers equipped with fuel-oil burners as standby. The gas is usually washed by oil in a suitable tank provided with suitable revolving blades at the outlet to remove oil from the gas. This is accomplished before the gas passes to pressure-regulating apparatus, and is designed to remove solid impurities. Methods of measuring the quantity and specific gravity of gas supplied by transmission lines to central power plants are described. Burner pressure for most installations is 15 lb. where combination gas and fuel burners are used. Boiler control is simple, the fuel supply to all burners being controlled by a master valve; any increase in demand is indicated by a drop in steam pressure. R. A. E.

665.511

1170. Natural Gas as a Chemical Raw Material. I. N. Beall. *Refiner*, 1936, **15**, 264–268.—A short discussion of the literature on the chlorination, nitration, sulphona-

tion, oxidation, thermal decomposition and reaction with steam of methane and other natural gas hydrocarbons. It is indicated that the possibilities have been proved but await development. G. R. N.

665.511 : 66.094.57

1171. **Cleaning High-Sulphur Gases.** M. J. Leahy. *Refiner*, 1936, **15**, 276–279.—The iron oxide, iron hydroxide suspension, the Feld, soda ash and Leahy processes of desulphurization of natural gas are described. Dismissing the first two processes as useless for high-sulphur gases, the author considers that the disadvantages of the Feld process are: (i) only two-thirds of the total hydrogen sulphide is removed; (ii) the sulphur obtained is acidic, impure, and of little value, (iii) the thionic acid solution is highly corrosive to the equipment. The Seaboard or soda ash process operates satisfactorily on low-sulphur gases, but with the high-sulphur gas it is uneconomic because of high rate of circulation and addition of make-up solution as well as total loss of sulphur. The author's own process (patented) consists of absorbing the H_2S in water which is then contacted with SO_2 to give free sulphur, finely divided and held in suspension in the water. This sulphur is flocculated by addition of a certain class of soluble electrolytes. It was found that the regenerated water (or solution) had decreased in absorption efficiency so another class of electrolytes was added to restore its absorptive power. This resulted in a marked increase of absorption efficiency and it was found that this solution containing two classes of electrolytes could be recycled indefinitely. The recovered sulphur after drying was found to be neutral and finely divided and suitable for fungicidal, fertilization and insecticidal applications. The process is being operated on a West Texas gas containing 9·2% hydrogen sulphide. G. R. N.

665.591.4

1172. **Construction and Operation of Natural Gasoline Plants. Part III.** R. L. Huntington. *Refiner*, 1936, **15**, 271–275.—In this Part the author deals with the gas-gathering and fuel-distribution systems and discusses raw-gas trunk lines, relationship between sizes of the suction and discharge lines, increasing the gas-handling capacity of a compressor station, large *versus* small lines, right-of-ways, construction of pipe-lines, kind of pipe to be used, drips, and residue return lines. Diagrams of drip assemblies are given. G. R. N.

547.21 : 547.313 : 668.3

1173. **Patents on Gas.** J. Y. Johnson. E.P. 447,470, 15.5.36. Production of olefins from saturated gaseous hydrocarbons by treating them with an oxygen-containing gas containing 10–45% by volume of oxygen referred to the initial hydrocarbons, at 750–950° C. and under 0·05–0·5 atm. pressure.

66.073.7 : 668.3

Soc. Franç. de Catalyse Générale. E.P. 451,130, 30.7.36. Production of propylene oxide by bringing a mixture of propylene and oxygen diluted with carbon dioxide into contact with a catalyst, *e.g.* silver activated with small quantities of gold and/or copper, at 300–375° C. and under a pressure of 50 kg./sq. cm. Water vapour is also added to the gases.

547.21 : 668.3

H. P. Stephenson and R. G. Israel. E.P. 451,575, 7.8.36. Olefine gases are prepared from medium and heavy oils in the cracking of coal–oil mixtures, by heating them to the b.pt., and passing the vapours through a cracking tube heated above the b.pt., of these oils.

547.21 : 668.3

J. Y. Johnson. E.P. 451,958, 14.8.36. Manufacture of unsaturated hydrocarbons by leading gaseous hydrocarbons through a Cowper apparatus which is heated periodically to high temperatures.

665.521.1 : 66.094.57 : 668.3

Bolidens Gruvaktiebolag. E.P. 452,073, 17.8.36. Purification of gases containing elementary sulphur in the form of vapour from solid or liquid impurities. The gaseous mixture is passed through one or more electrical gas purifying apparatus at 200–400° C. and at such a velocity that the sulphur is precipitated with impurities and drawn off from the apparatus. W. S. E. C.

Crude Oil.

665.514

1174. Oil Treating Methods. D. H. Fortine. *Oil & Gas J.*, 30.7.36, **35** (11), 71; 6.8.36, **35** (12), 42.—Following a brief discussion of the types of emulsion encountered in oil-fields and of the causes of their formation, various methods of emulsion breaking are described. These include: (1) use of the squeeze trap; (2) settling; (3) distillation; (4) centrifuging; (5) filter pressing; (6) chemical treatment; (7) electrical treatment. Methods 6 and 7 are those most frequently adopted and are, therefore, described in detail, the present trend being towards flow-line treatment as early as possible owing to the tendency of emulsion to stabilize with age.

6. *Chemical treatment.* The chemical, chosen after laboratory tests, is preferably injected between the casing and tubing of the well or in the flow line, heat being applied by gas engine heaters, firebox boiler heaters, tubular heaters, vertical boiler heaters, pipe heaters, or thermosyphon heaters. The thermal efficiency of each heating system is discussed. The cost of the chemical used in treatment varies from less than ¼ cent to 2 cents, that of heating being quite low.

A description is given of the components of the settling tank—viz., the conductor pipe, the spreader, the tank itself, the automatic water drain and the clean oil outlet. Columns piled with packed excelsior from pitch-free woods (*e.g.* aspen and cottonwood) are used for the treatment of the light emulsion at the bottom of the tanks.

7. *Electrical Treating Methods.* Electrical dehydration may be carried out either in the flow line or a tank, the former being the latest method. A diagram is given of a flow-line dehydrator which is automatically controlled. As the emulsion is fresh, little heat or chemicals are required. The tank system is also described, the emulsion being heated by high-pressure exhaust steam. The process is now generally automatically controlled by the following features: (1) automatic control of current by a choke coil; (2) automatic float-operated switch on the transformer primary which opens the electrical circuit when the dehydrator is not full; (3) relief valve on the dehydrator; (4) automatic flow of wet oil; (5) automatic temperature control; (6) automatic water level control.

The electrodes used in the dehydrator are now generally of the horizontal concentrated-field type, consisting of a nozzle which jets the emulsion along an electrode rod located inside a live shield, or of the concentric-ring type suspended from supporting brackets. In the latter type the emulsion may be introduced below the electrode unit, rising through the high potential field or in a horizontal plane directly into the electric field by means of a spreader cap. Details of the different methods of automatic control are given. The advantages of the flow-line system of electrical dehydration over the tank method are given as: (1) elimination of wet oil storage tanks and dehydrator feed pumps; (2) lower operating temperature, eliminating cooling towers, etc.; (3) elimination of chemical aid; (4) no re-running of partially dehydrated oil; (5) reduction in labour; (6) elimination of gravity losses; (7) lower plant investment cost.

It is emphasized that the cost of modernizing obsolete dehydration units is soon recovered by reduction in costs or increased gravity of crude, particularly when carried out on the fresh emulsion as in flow-line treatment. C. L. G.

665.514

1175. Oil-Treating Plant Designed to Break Hard Emulsion. J. C. Albright. *Oil Weekly*, 17.8.36, **82** (10), 32.—The emulsion found in some fields in Kansas is particularly hard to break especially when the oil stands in stock tanks for a considerable time. If the oil is treated as it is lifted the emulsion can be reduced fairly easily. Where the salt content is high the emulsion is more difficult to break.

The Skelly Oil Company has designed an efficient treating plant which can reduce the free water in the oil to less than $\frac{1}{10}$ of 1% and the saline content from 16,400 grains per barrel to about 8 grains per barrel.

The plant consists of three vertical columns, each of which includes an oil and gas separator in the top section. The lower portion of the column contains a predetermined amount of water through which the oil must pass. During its travel the temperature of the oil is raised to the most efficient treating point.

Special chemicals are used as treating compounds, and to operate the treater efficiently temperature and time must be considered. L. V. W. C.

665.514

1176. Luling Treating Plant. E. S. Post. *Oil Weekly*, 27.7.36, **82** (7), 34.—An emulsion-treating plant capable of handling 20,000 barrels of fluid per day has been constructed by the Magnolia Petroleum Company.

The plant consists of two 104 h.p. boilers, a number of tanks, six 185-barrel treating units, pump station and auxiliary equipment.

The fluid to be treated averages about 80% undesirable fluid. It is separated as much as possible in gunbarrel separators and is then treated electrically.

The fluid passes through a series of coils at the boilers in which it is heated to about 180° C under a pressure of 300 lb. From this point the fluid passes to the treaters without cooling and the basic sediment and water are run to the pits and the oil to the gunbarrel separators. L. V. W. C.

665.514 : 608.3

1177. Patents on Crude Oil. T. B. Wayne. U.S.P. 2,050,639–40, 11.8.36. Breaking and resolving emulsions of oil in water by the addition of a condensation product of a cyclic sulphonic acid and an aralkyl amine having its amino group in an alkyl side-chain.

665.514 : 608.3

M. De Groote, W. C. Adams, B. Keiser and A. F. Wirtel. U.S.P. 2,050,923, 11.8.36. Breaking petroleum emulsions of the water-in-oil type by the action of a demulsifying agent obtained by dehydrating a mixture of crystallized oxalic acid and castor oil by heating.

665.514 : 608.3

M. De Groote. U.S.P. 2,050,924, 11.8.36. Breaking petroleum emulsions by adding a compound containing stearyl-alpha-picolinium bromide.

665.514 : 608.3

M. De Groote. U.S.P. 2,050,925, 11.8.36. Breaking petroleum emulsions by adding a fatty-acid derivative of coconut oil.

665.514 : 608.3

M. De Groote. U.S.P. 2,050,926–30, 11.8.36 and 2,052,281–3, 25.8.36. Breaking petroleum emulsions by adding a demulsifying agent consisting of an oxyhendecenoic or oxy-octadecadiene acid residue and a keto- or dicarboxy-acid derivative of castor oil.

665.514 : 608.3

H. J. Robertson. U.S.P. 2,051,226, 18.8.36. Demulsifying cut oils by treatment with a soluble soap and furfural potassium hydrogen sulphite. W. S. E. C.

Refining and Refinery Plant.

621.57.04

1178. Iceless Refrigeration for the Natural Gasoline Plant Operator's Home. Anon. *Oil & Gas J.*, 23.7.36, **35** (10), 45.—In order to provide refrigeration in operators' homes and laboratories near stabilizer plants, reflux is drawn from near the bottom

of the accumulator into a water separator. The reflux then passes through a dryer half-filled with anhydrous calcium chloride or unslaked lime. The object of removing all water is to prevent freezing up at expansion orifices at the refrigerator inlets. Details of the construction of suitable refrigerating units are given with diagrams. Connections from liquid headers and to return vapour lines are indicated. The vapour return header may be connected to a recompressor, to plant suction, a low-pressure fuel header or to a vent stack. Headers and branches connected to each house are run underground to a depth of about 1 ft. The refrigerators should be situated on the rear porch, not in the house proper. R. A. E.

66.048

1179. The Kravtsov Tube Still. K. V. Kostrin. *Azerb. Neft. Khoz*, 1935, **7**, 77–84.—This still has the convection chamber placed under the radiant section, the convection tubes being arranged at right angles to the radiant tubes. The oil burners are placed at the front side, and the flame is directed upwardly by shields. The combustion gases pass from the radiant section through checker brick-work in a wide stream into a convection section, descend perpendicularly to the surface of the convection tubes, being finally discharged through a duct placed under the convection section. The radiant section is equipped with two banks of roof tubes and two sets of single-bank wall tubes. For. Petr. Techn.

66.048.2

1180. Heat Transmission with High Boiling Organic Compounds. E. F. Holsen. *Ind. Eng. Chem.*, 1936, **28**, 691.—This paper gives the physical properties of Dowtherm A (the eutectic mixture of 75% diphenyl oxide and 25% diphenyl) which are necessary for calculating heat-transfer rates when the material is used as a heat-transfer medium either in the liquid or vapour state. Heat-transfer coefficients obtained on test are given and the equations used in design are discussed with numerical examples. P. D.

66.048.2

1181. Heat Insulation in Air-Conditioning. R. H. Heilman. *Ind. Eng. Chem.*, 1936, **28**, 782.—The functions of heat insulation are to prevent heat loss and to prevent condensation on pipes. This paper presents a method for the determination of the correct thickness of lagging to apply in order to prevent condensation, and also gives tables and graphs for the calculation of heat transmission from objects at temperatures below and above room temperature. P. D.

66.048.37

1182. Fractional Distillation Columns. M. R. Fenske, W. Tonberg, D. Quiggle and D. S. Cryder. *Ind. Eng. Chem.*, 1936, **28**, 644.—Fractional distillation columns with at least 100 plates are necessary for the separation of petroleum into its main constituents. The advantages of such columns are realized when it is considered that an increase in the number of theoretical plates from 30 to 100 will increase the enrichment factor from 19 to 13,780 for substances with a relative volatility = 1·10 (*i.e.* with normal boiling points about 2·8° C. apart). Two columns, each 33 mm. O.D. and each equivalent to about 100 plates, are described. P. D.

66.048.37

1183. Liquid–Liquid Extraction. K. A. Varteressian and M. R. Fenske. *Ind. Eng. Chem.*, 1936, **28**, 928.—A packed column was used for the counter-current extraction of alcohol from benzene by water. The column was 3 m. long, 1·41 cm. diameter, packed with 4 mm.-diameter wire rings made of 26 B. and S. wire or with No. 19 single-link chain. The temperature was carefully controlled.

The tests were designed to investigate the effect on the efficiency of material of the packing, throughput, inversion of the phases, shape and size of packing and ratio of the feeds. Of these only the last two have a marked effect on the efficiency, the most important being the type of packing. The number of theoretical plates in the column was about 2·1 when packed with chain, against 4 when packed with wire rings. P. D.

66.048.37

1184. Design of Fractionating Columns. III.—Plate Efficiency and Number of Plates for Petroleum Columns. S. C. Singer, R. R. Wilson and G. G. Brown. *Ind. Eng. Chem.*, 1936, **28**, 824.—The possibility of using a McCabe and Thiele diagram for calculating the separation of complex mixtures in a fractionating column by treating all material boiling below a given temperature as one component, and all boiling above the temperature as the second component is discussed. The difficulty in this procedure lies in determining the equilibrium curve for the binary mixture chosen. The shape which the equilibrium curve assumes is first examined with reference to two cases calculated on rigorous lines by Underwood for total reflux and a reflux ratio (L/V) of 0·75. It is shown that a reasonably accurate estimation of the number of plates required may be determined by drawing an equilibrium curve lying within the area bounded by the first and last plates in the section considered. This procedure can be adopted when analysing the performance of a column in order to determine the overall plate efficiency. In addition to Underwood's calculated cases, test data obtained by the authors, Lewis and Wilde, Lewis and Smoley and Goodliffe are analysed in this way and it is shown that the overall plate efficiencies found are approximately the same as those obtained by the various authors enumerated when analysing the test data by the Hausbrand equation.

This procedure of obtaining the required equilibrium curve from the analysis of the terminal materials in the section is not possible in design, and a set of equilibrium curves is given, the suitable one of which may be chosen from the slopes of true boiling-point curves of the terminal materials. These slopes may usually be estimated when designing without difficulty. This method is capable of giving an approximately correct answer, but would appear to be limited to separations resulting from a comparatively small number of plates. P. D.

661.183.4

1185. Identification of Natural Decolorizing Earths. C. L. Alexanian. *Ann. des Comb. Liq.*, 1936, **11**, 471–486.—The method used is based upon the determination of a dehydration curve of the material. This is obtained by suspending a small quartz cup containing 1 gm. of powdered material, from one arm of a chain balance. The cup is surrounded by a vertical cylindrical electric furnace capable of reaching 1100° C. in about 2 hours. Proportional to the rise in temperature, is the loss in weight, due to water evolved. This change in weight can be followed continuously. With rise in temperature the manner in which the water is evolved indicates the nature of the earth. Thus absorbed water and adsorbed water are driven off continuously, whereas water of crystallization or constitution comes off relatively rapidly. It is found that natural earths of a given type lose their water always in the same way and at the same temperatures. Thus the curve obtained is related to the nature of the earth and, therefore, a method of identification is available. The author has examined various varieties of earths. Thus, kaolins show a brisk evolution of water of constitution towards 500° C. of about 10% by weight, whereas fuller's earths show a slower loss of water towards 500° C. of only 2–3% by weight. A comparative study has been made of natural earths from Vaucluse (France), Algeria and Morocco. An experiment with an activated earth, Tonsil A.C., shows that the curve obtained parallels that of the unactivated natural earth from which the Tonsil A.C. was prepared. This indicates that decolorizing power of natural or activated earths is essentially a surface phenomenon, *i.e.* an adsorption effect. W. E. J. B.

662.9

1186. Radiation Reaction at any Point in a Furnace Cavity. W. J. Wohlenberg. *Ind. Eng. Chem.*, 1936, **28**, 698.—A solution of the dynamical processes occurring in the furnace cavity requires evaluation of the radiation reaction with respect to its net effect at each of several classes of local or point zones within the cavity. This involves an extension of the idea of the radiant mean value with respect to the point under observation, of conditions affecting the net radiant exchange between the point and the enclosure, including its contents.

The classes of required local reference points are defined and expressions representing the net exchange between these points and the surroundings are included.

General forms of the expressions apply to any cavity for conditions stated. Special forms are included which apply to gas, grate, or pulverized coal-fired cavities.
P. D.

662.9

1187. Temperature in Industrial Furnaces. H. C. Hottel, F. W. Meyer and I. Stewart. *Ind. Eng. Chem.*, 1936, **28**, 708.—The significance of temperature measurements in industrial furnaces is discussed. The true gas temperature has less utility, except for making heat balances, than the uncorrected reading ordinarily obtained with a protected couple; the latter measures the rate at which heat would be transferred if the couple were replaced by a surface at the temperature of the heat sink. An instrument consisting in principle of a pair of oriented couples is shown to be capable of measuring the actual rate of heat-flow across any plane in a furnace. The instrument was tested at rates of radiant heat-flow across a plane of from 5000 to 18,000 B.Th.U. per sq. ft. per hour, with an average error of 4% in 8 tests. Its application to a study of uniformity of heat distribution in furnaces is discussed. P. D.

665.521.2

1188. New Refinery will make 70 Octane Gasoline from Californian Crude. J. W. Westsmith. *Nat. Petr. News*, 29.7.36, **28** (31), 25.—The maximum capacity of the cracking plant which is described is 12,500 brl. daily. It consists of a two-coil selective cracking unit for light oils and a 4-cell equiflux unit for heavy oil. All possible precautions have been taken to minimize corrosion. The employment of boilers running on distilled water and operating at 450 lb. pressure, of economizers and heat exchange, of waste gases for fuel and of steam-driven pumps, makes the plant economical to run. Operation and control are centralized and automatic as far as possible. H. G.

665.521.7 : 66.061.3

1189. Fractionation of Petroleum Residues with Natural Gas under Pressure. S. von Pilat. *Oil & Gas J.*, 23.7.36, **35** (10), 54.—From the results of earlier work, it would be expected that when methane is forced into a propane solution of an oil mixture which has been freed of asphalts and highly aromatic colouring substances, aromatic components of much lower mol. wt. would be precipitated, together with very high mol. wt. oils of paraffinic character. This has been proved by experiments. In one example, 66% was distilled off under 0·2 mm. pressure without dephlegmator from a lubricating oil fraction precipitated by methane between 70/100 atm. The properties of charge, distillate and residue were:

	Charge.	Distillate.	Residue.
Sp. gr.	0·9275	0·9315	0·9190
Visc. E. at 50° C. . .	15·27°	9·02°	40·7°
V.I.	44	19	71

The solubility of the gas used for precipitation is an important factor; for example, hydrogen requires a pressure of 120 atm. to produce the same results as natural gas at about 30 atm. Comparison of CO_2, natural gas, nitrogen and hydrogen is given. Results of this type of fractionation also depend on the solvent in which precipitation is effected and propane has been selected for practical tests. Experiments have shown that a pressure cylinder partly filled with propane is able to hold more methane at a given pressure than an empty cylinder, whereas with pentane and heavier hydrocarbons the amount of methane is reduced.

Tables show the fractionation of Rumanian and Venezuelan residues by this method. At 8 atm. pressure, which is the pressure of the propane fraction used, asphalts are precipitated. Methane is then charged and at 40 atm. colouring substances of highly aromatic character are precipitated. Further increases in pressure up to 130 atm. result in oily fractions appearing as a second, heavier liquid phase. The properties of the individual fractions and of the residue are given. The residue amounts to

about 4% in the case of Rumanian and 2% in the case of Venezuelan residue. The intermediate fractions contain 30–40% of methane and propane when separated, and the solvent is removed by heating. When cresol is added to the solution of heavy hydrocarbons in propane and natural gas forced in, a cresol solution of hydrocarbons separates out as a second liquid phase and on further addition of natural gas, 3 liquid phases are formed. The lowest layer contains cresol saturated with aromatic compounds and a small amount of light hydrocarbons, the middle layer consists mainly of heavy hydrocarbons and the top layer is a propane-methane solution with little oil or cresol. It is not known definitely whether this method can be used on a technical scale.

Fractionation with gas solution provides a suitable method of separating high mol. wt. components and substances sensitive to heat from crude oil for examination. It is thought that the dark-coloured substances precipitated at 30–50 atm. represent those removed in the normal way by acid. The properties of these gummy semi-solid substances are: sp. gr. 0·99/1·02, visc. E. at 100° C. about 20°, mean mol. wt. 450–500. The asphalts obtained by propane precipitation are brittle, but can be made ductile by fluxing with the resinous fraction. Unmixed they are suitable for preparation of paints, etc. R. A. E.

665.541

1190. Application of Centrifuges in Modern Refineries. R. H. Dolton. *Petr. Zeit.*, 26.8.36, **32** (34), 1.—A short review is given of the most important applications of centrifuges in petroleum refineries, *e.g.* for dewaxing hydrocarbon oils and for the continuous acid-treatment of hydrocarbon oils and cracked benzenes, and in the hypochlorite process. In the Sharples apparatus light diluents such as benzene are used and the De Laval $S - N$ employs heavy solvents such as chlorinated hydrocarbons. The power and cost of these centrifuges are given together with photographs of the plants at Petit-Couronne Refinery, Shell Refinery, Curaçao, Standard Oil Co. at Port Jerome, Imperial Chemical Industries, Billingham, and at Berry-Wiggins Refinery, Kingsnorth, Kent. W. S. E. C.

662.9 : 608.3

1191. Patents on Refinery Plant. Bethlehem Steel Co., H. Davis and L. H. Fister. E.P. 449,009, 15.6.36. Improved automatically-controlled high-temperature furnaces.

662.927 : 608.3

Houdry Process Corpn. E.P. 449,050, 19.6.36. Temperature-regulating apparatus for the control of the reaction temperature of contact masses.

620.193 : 608.3

National Aluminate Corpn. E.P. 450,547, 20.7.36. Prevention of corrosion in systems containing water by adding to the water, trisodium phosphate and commercial tannin.

620.193 : 608.3

National Aluminate Corpn. E.P. 451,929, 10.8.36. Treatment of boiler feed-water to render it non-corrosive and to decrease foaming and scale formation, by adding to the water 44% by wt. of sodium carbonate, 47% of anhydrous disodium phosphate and 9% of corn starch.

66.048.1 : 608.3

W. T. Hancock. U.S.P. 2,048,547, 21.7.36. Improved tube still for cracking plants.

66.048.3 : 608.3

F. W. Stone. U.S.P. 2,048,576, 21.7.36. Oil fractionation apparatus.

66.048.3 : 608.3

A. J. Slagter and C. W. McKay. U.S.P. 2,048,973, 28.7.36. Apparatus for selective vaporization under predetermined conditions of pressure or vacuum of crude

petroleum or its derivatives in a plurality of zones; straight-run and cracked spirit, kerosine, lubricating oil, etc., are produced.

66.048.1 : 608.3

M. J. Burkhard. U.S.P. 2,049,247, 28.7.36. Distillation of hydrocarbon oil to strip it of light ends to improve the flash point.

662.9 : 608.3

J. A. Guyer. U.S.P. 2,051,335, 18.8.36. Improved furnace for controlling temperatures in cracking, polymerization or hydrogenation reactions. W. S. E. C.

Corrosion.

620.19

1192. Corrosion of Metals by Water and Carbon Dioxide under Pressure at Normal Temperature. F. H. Rhodes and J. M. Clark, Jr. *Ind. Eng. Chem.*, 1936, **28**, 1078.—The initial rate of attack of metals by saturated aqueous solutions of carbon dioxide under pressure is often much higher than the final rate attained; the data given are for the final rate. The rate of corrosion of two carbon steels is shown rapidly to increase as the pressure is raised to 300 lb. per sq. in., further elevation of pressure to 450 lb. per sq. in. has little effect on the rate of corrosion. Six stainless steels are proved to be practically unaltered at 450 lb. per sq. in. Data are also given for the corrosion rates of seven non-ferrous metals, some of which show lower rates than those for carbon steels. Analyses of all metals are given. J. W. H.

620.19

1193. Organic Inhibitors of Corrosion. Aromatic Amines. C. A. Mann, B. E. Lauer and C. T. Hultin. *Ind. Eng. Chem.*, 1936, **28**, 1048.—The aromatic amines form salts, with the corroding acids which ionize to give positive inhibitor ions which form a protective layer on absorption by the cathode surface. Data are given showing the relationship between nineteen various *mono-* and *di*-substituted aromatic amines and their efficacy in reducing the corrosion of mild steel with respect to dilute sulphuric acid. The method of test employed is identical with the one described in the authors' article on the aliphatic amines (*Ind. Eng. Chem.*, 1936, **28**, 160). Making certain assumptions as to the physical shapes of the various molecules it is shown that the greater the cross-sectional area of the inhibitor ion the better the inhibiting value; further, that any change of structure causing the ring or rings of these aromatic amines to be inclined from the perpendicular to the metal surface results in a greater cross-sectional area and hence an increased inhibiting value. J. W. H.

Cracking.

66.092

1194. Modern Cracking Process, Part I. G. Egloff and E. F. Nelson. *Oil & Gas J.*, 25.6.36, **35** (6), 50.—Cracked gasoline was produced commercially in the U.S. in 1913, but was looked upon as inferior to straight-run gasoline. Since then the anti-detonating properties of the cracked gasoline have been appreciated, and in 1936 one-fourth of the 217,560,000 brl. of straight-run gasoline produced in the U.S. was reformed to improve the anti-knock value, and 205,920,000 additional brl. of cracked gasoline were produced.

In 1912 the average yield of gasoline from crude was 12% and in 1935 was 45%. Investment in cracking units in 1913 amounted to 2 million dollars whereas at present it amounts to over 400 million dollars and 5 million dollars are expended annually in research in the art of cracking. Progress which has been made in flexibility of operation, in increasing temperatures and pressures used and consequently raising the yield of gasoline, and in increasing the length of runs, is reviewed.

The operation of a modern 5800-brl. crude oil selective cracking unit is described and illustrated. In this type of plant separate heaters are provided for the heavy residue and for the light oils obtained as side cuts from the crude fractionating column and the fractionating column of the cracking unit.

Operating data, yields and properties of products obtained when treating a variety of crude, topped crudes and distillates in such a unit are tabulated. During a 62-day run in a plant of this nature processing 365,214 brl. of East Texas crude, a yield of 63·4% of gasoline having an octane number of 69 was obtained. A smaller plant operating on various Pennsylvanian products to produce alternately coke and cracked fuel ran for 168 days, processing 256,498 brl. of charging stock. The coke deposit in the heating tubes after the run was very small.

The catalytic process for converting gases from cracking plants into motor fuel is described and illustrated. Tables show the properties of some typical gases from cracking units and of polymer gasoline. The polymer gasoline has an octane rating of 81 and its production adds 3–5% to the yield of gasoline from the cracking process and increases the octane rating from 1 to 2 numbers. By concentration of the butenes and butanes in cracked gases, selective polymerization of the *iso*butene to *di-iso*butene followed by mild hydrogenation, *iso*-octanes having octane ratings of 96–100 are obtained. Blending values of polymer gasoline, *iso*-octane and benzole in gasolines of 45–65 octane number are shown to illustrate the high value of the first two products. R. A. E.

66.092

1195. Modern Cracking Process, Part II. G. Egloff and E. F. Nelson. *Oil & Gas J.*, 2.7.36, **35** (7), 34.—Petroleum fractions from any given crude and particularly fractions from crudes of different source differ widely in properties such as specific heat, latent heat, vapour volume, critical pressure and temperature, and rates of decomposition. It is important to know these properties of the oil to be cracked in designing plant, but such determinations are lengthy and costly. To determine the paraffinicity of an oil, the U.O.P. Characterization Factor may be used. This is based on the observation that when a crude oil of supposedly uniform character is fractionated into narrow cuts, the sp. gr. of these cuts is approx. proportional to the cube roots of their absolute boiling points. The proportionality factor may then be taken as indicative of the paraffinicity of the stock. Thus $K = \frac{\sqrt[3]{TB}}{S}$, where K = U.O.P. Characterization Factor, T^B = average b.pt. absolute, S = sp. gr. at 60° F. When dealing with mixture of wide b.pt. range the special method described by Watson and Nelson (Abstract 146 of 1936) must be used, but for narrower cuts the Engler 50% pt. may be used. Values of Characterization Factor range: Pennsylvania stocks 12·2–12·5; Mid-Continent 11·8–12·0; Gulf Coast 11·0–11·5; cracked gasolines 11·5–11·8; Recycle stocks 10·0–11·0; cracked residuums 9·8–11·0. Graphs show relationship between Characterization Factor and (1) average b.pt. and A.P.I. grav.; (2) viscosity at 210° F. and A.P.I. grav.; (3) viscosity index; (4) aniline pt. and average b.pt. The first method is to be preferred. Numerous other charts are presented to permit ready determination of the characteristics of oils from relatively simple tests. Such properties as hydrogen content, critical temperatures and pressures, thermal expansion and compressibility, specific heats in liquid and vapour state, latent heat of vaporization, effect of pressure on heat content, high-temperature viscosities can be estimated from them. The reaction velocity, or rate of production of material of boiling range lower than the I.B.P. of the charge, varies with the width of boiling range for mixtures of the same average properties. In commercial cracking it is doubled by a change of approx. 21° F. at 800° F. and by 26° F. at 900–950° F. Rate of polymerization, or production of material of boiling range higher than the F.B.P. of the charge, is believed to be less affected by temperature. Refractory stocks of low U.O.P. Characterization Factor not only give lower initial reaction velocity, but show much greater change in reaction velocity with increased conversion. Other factors being equal, the higher the average b.pt. of the stock, the higher the cracking rate. For satisfactory plant design and yield calculations it has been necessary to correlate rate of reaction with all the variables mentioned. R. A. E.

66.092.122.2

1196. Design of Cracking Units. S. N. Obryadchikov. *Neft*, 1936, **4**, 19–21.—It is stated that the consumption of fuel per unit of pressure distillate is smaller the higher

the amount of oil passed through the high-pressure coil (Winkler–Koch unit). The correct loads of the coils can be ascertained by making a balance of the materials and heat, which must be checked by calculating the processes of separation of cuts in the towers. The coils must be constructed for a minimum of heat input which is assured in the reducing coil by a minimum of recycle stock, and in the high-temperature cracking oil by the temperature of the condensate, which depends on the pressure in the second tower and the amount of cracking per cycle. The tower must be able to work at various pressures. The first tower must work at a pressure not exceeding 2 atm., which will permit a low recycle ratio in the reducing coil, while the second tower must work at the highest possible pressure, so as to lower the heat input in the high-pressure coil. In the large-size 2-furnace cracking coil one of the furnaces should be substituted by a heat exchanger when "reducing" the fractions, which will lower the cost of equipment, cut the fuel expenses and will permit a higher throughput with 2-furnace units. For. Petr. Techn.

66.092.123

1197. Reaction Chambers in Cracking. S. N. Obryadchikov. *Neft*, 1936, **7** (6), 17–18.—In accordance with the results of experiments it is stated that: The yield of cracked products is increased from 16 to 19% when using a reaction chamber, thereby lowering the amount of recycle stock from 4·2 to 3·5% and thereby increasing the throughput of the cracking unit. The more severe cracking of the oil occurring through the use of a reaction chamber yields a lighter gasoline. An increase in the polymerization products was not observed. For. Petr. Techn.

66.092.123

1198. New Forward Cracking Process Makes 75% of Substituted Benzenes. Wm. Kaplan and W. E. Forney. *Nat. Petr. News*, 8.7.36, **28** (28), 35.—The relationship between chemical constitution and anti-knock value is discussed and the results from an experimental cracking plant are reviewed. In the latter, gas-oil was preheated to 900° F. and passed through a cracking coil consisting of 2300 ft. of 1-in. tubing. At a charging rate of 180 g.p.h. the temperature of the issuing vapours was 1075° F. and the pressure 225 lb. per sq. in. The condensable products were of sp. gr. 14·1° A.P.I. On redistillation the following yields were obtained: Gasoline (410° E.P.) 51·6%; benzine bottoms 5·8%; residuum (1·2 sp. gr.) 41·7%. The composition of the gasoline fraction is given as olefins 4·8–8·6%, aromatics 85·4–91·4%, naphthenes 9·8–0·0%, paraffins absent. Fractional distillation of the gasoline separated fractions in which benzene, toluene, xylene, naphthalene and alkyl-substituted benzenes up to *N*-amyl benzene were identified qualitatively. H. G.

66.092.122 : 608.3

1199. Patents on Cracking. M. B. Cooke, U.S.P. 2,046,501–2, 7.7.36. Improved fractionating equipment in cracking operations.

665.521.7 : 66.092.14 : 608.3

E. W. Isom. U.S.P. 2,046,749, 7.7.36. Production of motor fuel by vapour-phase cracking of residual fuel-oil to 950° F. and then passing the cracked products together with a gas mixture containing at least 20% of free hydrogen maintained at 1200° F. through a body of coke into an overlying layer of oil and pitch which is undergoing conversion to coke.

66.092.122 : 608.3

W. R. Howard. U.S.P. 2,046,898–9, 7.7.36. Cracking operation in which the vapours formed during conversion are subjected to a series of dephlegmations and the reflex condensates formed are separately re-treated under conditions to cause further conversion.

66.092 : 608.3

C. H. Angell. U.S.P. 2,047,761, 14.7.36. Cracking operations in which the relatively light and relatively heavy oils are separated and cracked separately and the conversion products commingled from both heating coils.

66.092 : 608.3

C. O. Melberg. U.S.P. 2,048,351, 21.7.36. Improved furnace for cracking plants.

66.092.165 : 608.3

W. T. Hancock. U.S.P. 2,048,546, 21.7.36. Maximum recovery of anti-knock gasoline by two-stage heating and vaporization—the first at a temperature below and the second at a temperature above cracking. The oil is treated in certain stages in the system with fuller's earth.

66.092.12 : 608.3

W. T. Hancock. U.S.P. 2,048,548, 21.7.36. Liquid phase cracking to increase the yield of motor spirit by means of a passage of the charge through a tube still.

66.092.8 : 608.3

C. H. Angell. U.S.P. 2,048,986, 28.7.36. Reforming of cracked spirit in cracking operations to improve the anti-knock value.

66.092.4 : 608.3

P. H. Sullivan and H. V. Atwell. U.S.P. 2,050,025, 4.8.36. Catalytic cracking of hydrocarbon oil using as catalyst aluminium or ferric chloride in the vapour form.

662.757 : 66.092 : 608.3

A. Fisher. U.S.P. 2,050,427, 11.8.36. Cracking of coal–oil mixtures to obtain in particular low volatile coke and motor spirit.

66.092 : 608.3

J. D. Seguy. U.S.P. 2,050,467, 11.8.36. Cracking of hydrocarbon oil to obtain maximum yield of anti-knock gasoline. Preheated or cold raw oil is introduced into any or all of the streams of reconverted intermediate products before these streams enter the reaction chamber.

66.092.122.2 : 608.3

LeRoy G. Story. U.S.P. 2,050,816, 11.8.36. Cracking to produce high anti-knock gasoline by reforming or converting low anti-knock gasoline under heat and pressure.

66.092 : 608.3

P. C. Keith, Jr. U.S.P. 2,050,847, 11.8.36. Hydrocarbons are lightly cracked and introduced into a common evaporating zone along with a more highly cracked stock. Two condensates are obtained and the heavier condensate is mixed with the initial stock and lightly cracked while the lighter condensate is fractionated.

66.092.88 : 608.3

J. A. Wales. U.S.P. 2,050,986, 11.8.36, and M. P. Youker. U.S.P. 2,051,325, 18.8.36. Cracking of hydrocarbon oils to reduce coke formation in the reaction chamber.

66.092.4 : 608.3

L. A. Dubbs. U.S.P. 2,051,471, 18.8.36. Thermolyzing hydrocarbon oils by passing them, after preheating, in a restricted stream at a suitable pressure through an electrically heated carbon-resistant tube. Nickel oxide suspended in the oil acts as catalyst.

66.092.14 : 608.3

E. A. Ocon. U.S.P. 2,052,148, 25.8.36. Hydrocarbon oils are heated to below cracking temperature and then vaporized in the presence of hydrogen under pressure. The products are then subjected to the action of superheated steam and rapid cracking treatment at 1000–1500° F. On cracking, the temperature is reduced to 900–1100° F. Tubes constructed of Pd–Mo–Cr–Ni alloy act as catalysts in the reaction.

66.092 : 608.3

J. F. Donnelly. U.S.P. 2,052,340, 25.8.36. Cracking of selective fractions of hydrocarbon oil to produce motor spirit of high anti-knock value and fuel-oil of low viscosity.

66.092.165 : 608.3

M. Munteanu. E.P. 451,341, 4.8.36. Cracking of hydrocarbon oils or coal–oil suspensions in two stages in which the temperature is increased to 250° C. at the end of the first stage and to cracking temperature at the end of the second stage.

66.092.4 : 608.3

J. Y. Johnson and I.G. Co. E.P. 451,656, 6.8.36. Cracking of hydrocarbon oils at 420–500° C. and under pressures of 50–200 atm. in the presence of small quantities of a halogen or halogen hydride. W. S. E. C.

Hydrogenation.

66.094.1 : 60.38

1200. Patents on Hydrogenation. H. E. Potts. E.P. 450,705, 23.7.36. Hydrogenation of carbonaceous substances in which hydrogenating gases are circulated, the condensable constituents condensed and the lowest boiling benzene constituents removed by cooling to − 30 to − 40° C. A regulated partial stream is then branched off from the cycle, foreign gases removed by low-temperature cooling, and this stream is then combined with the other part of the cycle. A hydrogenating gas of desired composition then enters the reaction chamber.

66.094.1 : 608.3

E.I. Du Pont de Nemours & Co. E.P. 449,957, 7.7.36. Hydrogenation of rubber and naphthalene or anthracene, in two stages, one at mild and the other at elevated temperatures and pressures. A compound or metal of group 8 of the periodic system is used as catalyst.

661.96 : 608.3

E. L. Rinman. E.P. 450,416, 17.7.36. Production of hydrogen. Carbon is mixed with potassium or barium carbonate in the presence of steam and heated to 500° C. A portion of the gas mixture (H_2 and CO_2) is circulated from the upper part of the reaction chamber through a superheater in which the temperature of the mixture is raised, to the lower part of the reaction chamber for the purpose of supplying heat necessary for the reaction.

66.094.1 : 608.3

H. E. Potts. E.P. 450,473, 20.7.36. Hydrogenation of carbonaceous substances in the liquid phase at 380–550° C. and at least 20 atm. pressure, using as catalyst a hydrogen halide, *e.g.* ammonium chloride.

66.094.1 : 608.3

Coutts & Co. E.P. 452,095, 17.8.36. Hydrogenation of carbonaceous substances at 175° C. using as catalysts metals, *e.g.* Fe, Co, Ni, Mo, W, Cr, V, Sn ,Ti, Pb, Mn, Al, Zn or Zr but excluding Si, the activity of which have been increased by treatment with ammonium fluoride. The catalysts are applied in the presence of alkaline substances. W. S. E. C.

Polymerization.

547.313 : 66.095.26 : 608.3

1201. Patents on Polymerization. C. R. Wagner and R. C. Osterstrom. E.P. 451,788, 12.8.36. Conversion of olefines into high anti-knock gasoline by contacting the gases with a solvent which is a poor solvent for hydrogen and methane. The gas separated is fractionated from the solvent into a gaseous and liquid portion and the latter is

polymerized. Naphtha is added to the polymerization zone to reform it and to regulate the polymerization reaction.

547.313 : 66.095.26 : 608.3

A. Carpmael. E.P. 450,592, 20.7.36. Polymerization of olefines in the presence of an acid ester of an acid of phosphorus, *e.g.* monocresyl phosphate using as catalyst a copper or silver salt.

547.313 : 66.095.26 : 608.3

A. Carpmael. E.P. 450,668, 20.7.36. Polymerization of olefines (except *iso*butylene) in the presence of a solution of an anhydride of an acid of phosphorus in a liquid acid of phosphorus. A copper or silver salt is used as catalyst.

547.313 : 66.095.26 : 608.3

A. Loebel. U.S.P. 2,051,612, 18.8.36. Polymerization of olefines obtained from vapour-phase cracking to produce greater yields of lubricating and diesel oils. The products are refined with aluminium or zinc chloride before polymerizing.

547.313 : 66.095.26 : 608.3

V. Ipatieff and V. Komarewsky. U.S.P. 2,051,859, 25.8.36. Polymerization of olefines, in particular of ethylene, at 150–220° C. and under 5–20 atm. pressure in the presence of phosphoric acid as catalyst. Sufficient quantity of an extraneous liquid mono-olefin is present to permit polymerization. W. S. E. C.

Motor Fuels.

665.521.2

1202. Finishing P.D. into Gasoline. W. L. Nelson. *Refiner*, 1936, **15** (7), 247–250.—The commoner methods of treating P.D. are: (1) acid treatment followed by redistillation and sweetening; (2) vapour-phase earth treatment; (3) liquid-phase earth treatment; (4) use of inhibitors and dyes. In connection with (1) the case is analysed of increase of acid treat and corresponding decrease is redistillation steam consumption and it is shown graphically that total cost of treatment passes through a minimum which represents the most economical operation. The view is taken that steam temperatures below 300° F. are not economical and that in many instances steam plus vacuum plants working at 225–250° F. cannot compete with steam plants operating at 325–350° F. The main cost in vapour-phase treating is the royalty charge. The following comparison of costs is given—in cents per brl.:—acid and steam 6–14, acid and vacuum 6–10, clay vapour phase 0·8–4, clay liquid phase 1–8, inhibitors 1–4. G. R. N.

665.521.2 : 536.423

1203. Survey of the Volatility of Motor Fuels. T. W. Legatski. *Nat. Petr. News*, 3.6.36, **28** (23), 28.—For the purpose of illustrating the trend in the properties of representative gasolines over the past 6 years the Reid Vapour Pressure, Volatility Number (284° F. minus the 50% end-point temperature) and butane content (according to Alden and Blair) have been tabulated. It is shown that vapour pressure has risen steadily from 8·05 in December 1929 to 9·62 in March 1936. The volatility number likewise shows a steady increase from 21 to 50, whilst the butane content has remained fairly constant at about 6·0. The factors responsible for these changes are notably the recovery of refinery gases, and the development of the cracking processes. Prior to 1925 natural gasoline was the material primarily responsible for the increase in the volatility of gasoline. Arguing from the basis of natural gasoline production figures, its effect on volatility and the total increase up to date of volatility, it is shown that the natural gasoline equivalent of refinery vapour recovery gasoline was 74,000,000 brl. in 1935. H. G.

665.521.2 : 620.19

1204. Motor Fuels amd Corrosion. S. Doldi. *Chimica e L'Industria*, 1936, **18**, 226–229.—The tendency of a number of motor fuels containing alcohols to corrode

metal (aluminium, copper, bronze, brass, Monel metal and steel) has been investigated by immersing the metal in the fuel for from 2 to 8 months. It is found that hydrated alcohols attack metal more severely than anhydrous alcohols and ethyl alcohol is less corrosive than methyl alcohol. The denaturants added to alcohols actively induce corrosion. Monel metal appears to be the most resistant of the metals examined, followed by bronze, brass and hard steel. Aluminium is the most susceptible to attack. Benzole free from sulphur comes next to benzine as the least corrosive fuel, while of the alcohol blends tested, equal parts of benzine and ethyl alcohol is the most satisfactory blend in this respect. C. C.

665.521.2 : 66.067.1

1205. Vapour-Phase Treatment. V. T. Brashnikov. *Neft*, 1936, **7** (4), 21–23.—A gasoline complying with the specifications was obtained in a vapour-phase treatment with Zikeev (Russian) clay. This applies particularly to the second-grade gasoline, which showed identical results for acid and clay treatment. The clay consumption amounted to 0·3% without regeneration of the clay and 0·18% with regeneration, on the gasoline treated. The corrosive properties of the gasoline were eliminated by a treatment with ammonia or soda. For. Petr. Techn.

665.521.2 : 66.067.72

1206. Re-running Acid-Treated Cracked Naphthas over Alkalis. G. M. Woods. *Petr. Eng.*, August 1936, **7** (12), 38.—Laboratory experiments have indicated the improvement in colour and reduction of acid requirements obtained by carrying out the redistillation of acid-treated naphthas over alkalis. The alkaline solution neutralises the SO_2 liberated by the decomposition during distillation of the dialkyl sulphates, which would otherwise give the overhead bad colour and colour stability. Most alkalis are suitable, but ammonia has only a slight effect. A table of colours of cracked naphtha after treatment in the laboratory, with varying percentages of H_2SO_4 and redistillation over varying amounts of caustic soda, illustrates the saving effected. *E.g.* treatment with 6 lb. acid per brl. of oil and re-running over 8 c.c. of NaOH soln. per gal., gave a better colour than acid treatment with 12 lb. per brl. followed by re-running without caustic. Results have been duplicated in the plant, giving a saving of $330 per day. No trouble from caustic embrittlement of the stills has been observed. C. L. G.

665.521.2 : 66.094.57

1207. Economies in Doctor Treating. C. W. Berger. *Refiner*, 1936, **15**, 255–259.—Most of the losses attendant on a plumbite treating system are due to carry over and evaporation. Loss by carry over is the loss of lead sulphide and doctor solution remaining in the agitator and which is washed away in the subsequent water or caustic treat together with some gasoline. This loss can be reduced by improving the settling and separation operations as well as by the use of traps to catch the lead sulphide. Turbulent mixing is undesirable, and the following recommendation is made. In commencing the treatment a small excess of sulphur is added so a clean "break" is obtained. A full tank of regenerated doctor solution is prepared and fed into the treater with the gasoline. The doctor solution is not recirculated but allowed to accumulate in the settlers, and by supplying fresh solution continuously only a small amount (about 1%) is required for the desired sweetening effect. This method connotes fairly constant conditions, and eliminates lead sulphide recirculation and reduces emulsion tendencies. The advantages claimed are less steam consumption and wear on doctor pumps and elimination of shut downs for changing over to another batch of doctor solution. Black strap produced by doctor treatment may exist in two forms, heavy and/or light according to particle size and degree of emulsification. These forms can be separated in slow-moving water, the light form taken from the surface by placing semicircular troughs in the stream perpendicular to the flow and the heavy from the bottom by use of mudhog pumps. The average composition of black strap is 45% gasoline, 43% spent doctor and 12% lead sulphide, and steam regeneration of this material means total loss of the gasoline estimated at 80 gal. per 1000 brl. The remedy suggested is the application of the centrifuge to separate the gasoline, then regenerate the spent doctor in the usual way. Other sweetening processes are shortly discussed. G. R. N.

66.061.5 : 668.3

1198. Patents on Motor Spirit. Ruhrchemie A.-G. E.P. 449,013, 10.6.36. Use of activated carbon for extracting fuel mixtures from coke-oven gases. The absorption operation is carried out after the removal of benzene and hydrogen sulphide and between corresponding stages of the compression of the gas at from 1–5 atm. pressure.

665.531.2 : 66.067.72 : 668.3

F. J. Skowronski. U.S.P. 2,046,907, 7.7.36. Treatment of cracked spirit to remove colour and gum-forming constituents with copper silicate in the presence of hydrochloric acid and steam.

665.521.2 : 668.3

N. D. Scott. U.S.P. 2,048,169, 21.7.36. Refining of motor spirit by contacting with a solid addition compound, *e.g.* sodium and naphthalene wet with a polyether.

665.521.2 : 66.094.57 : 668.3

M. P. Youker. U.S.P. 2,048,241, 21.7.36. Removal of H_2S from crude gasoline by application of a vacuum at low temperatures. The liquid product (free from H_2S and other gases) is then led under pressure to a rectifying zone at 100–300 lb./sq. in. and heat is applied to the lower portion.

665.521.23 : 668.3

O. Fitz Simons. U.S.P. 2,048,522, 21.7.36. Production of high anti-knock gasoline by extracting cracked naphtha with sulphur dioxide.

665.521.2 : 66.094.57 : 668.3

J. C. Morrell. U.S.P. 2,049,016, 28.7.36. Removal of sulphur and gum-forming constituents from cracked spirit by treating it in the vapour form with aqueous sulphuric acid containing sufficient pyridine to reduce the reactivity of the acid.

665.531.2 : 66.094.3 : 668.3

R. T. Howes. U.S.P. 2,047,475, 14.7.36. Neutralization of cracked spirits by concurrently flowing a mixed stream of water containing finely ground magnesium hydroxide and acid-treated distillate through a stationary body of magnesium hydroxide.

665.521.2 : 66.094.57 : 668.3

E. S. Brown and D. B. Nutt. U.S.P. 2,049,423, 4.8.36. Sweetening of light petroleum distillates by contacting them with an alkaline solution containing lead sulphide in suspension. The contacting is carried out in the absence of free sulphur and the solution is maintained free from dissolved lead by the addition of a suitable chemical agent adapted to precipitate lead compounds from solution.

665.521.2 : 66.094.57 : 668.3

R. B. Day. U.S.P. 2,051,939, 25.8.36. Refining light petroleum distillates to remove sulphur by adding hydrochloric acid in the presence of copper chloride or oxide.

W. S. E. C.

Lubricants and Lubrication.

621.891.23

1200. Oiliness in Motor Oils. Part I. S. Kyropoulos. *Refiner*, 1936, **15**, 269–70.—Of the many factors involved in the property of oiliness the author deemed it was first desirable to push the hydrodynamic theory of lubrication as far as possible, and so in 1928 advanced the hypothesis of molecular flow, orientation and consequent drop of viscosity under bearing operating conditions and demonstrated, with Prandtl machines, that motor oils are easily oriented at normal speeds giving a 10–17% drop of viscosity, while down to film thicknesses of 0·0023 mm. the laws of hydrodynamics held. Turning to cylinder wear the causes are stated to be: (1) mineral dust; (2)

poor initial polish; (3) corrosion at low operating temperatures; (4) destruction of polish; (5) deterioration of oil. While the entry of dust is unavoidable the abrasive nature of this substance can be materially reduced by choice of a suitable oil. The best polish is given by oils of low coefficient of static friction. The oil molecules must form films with strong lateral intermolecular cohesion and orient themselves on surfaces at a steep angle. To avoid excessive viscosity of the oil in bulk for hydrodynamic reasons "polar" oils may be added to mineral oils of lower viscosity; these oils present the advantage of a firm anchoring to the surface with their polar group. Additional advantages of these "polar" oil additions are reduction of corrosion by virtue of superior wetting and minimization of oil deterioration because the polar nature of the oxidation products increases their molecular force of attraction to the oil rather than to the metal. G. R. N.

621.892.098

1210. Phenol Treatment of Oils. N. Kalantar, M. Kovol'chuk and V. Reginskaya. *Azerb. Neft. Khoz.*, 1935, **9**, 65–67.—Satisfactory results were obtained when treating turbine and transformer oil distillates with 100 parts phenol in three consecutive batches (30, 30 and 40%) at 40–45° C., followed by a treatment with 3% acid and 10% clay. The obtained results were in many instances superior to the Edeleanu treatment, although the yields of the finished products were low, amounting to 50–70% for turbine and 50–60% for transformer oils. For. Petr. Techn.

621.892.21

1211. Chemical Structure of Lubricating Oils. L. A. Mikeska. *Ind. Eng. Chem.*, 1936, **28**, 970–984.—In order to correlate chemical structure with the common physical properties of lubricating oils some 52 compounds conceivably present in lubricating oils have been synthesized and analytical data obtained. The hydrocarbons prepared consist of various aromatic nuclei to which are attached side chains varying in size, nature and number. The following are the author's main conclusions: (1) the greater the complexity of the ring the higher the viscosity; (2) reduction of an aromatic to a hydroaromatic ring increases the viscosity without changing the viscosity index (V.I.); (3) providing the number of side chains remains unchanged, the V.I. increases as the ratio of paraffinic to naphthenic carbon atoms increases; (4) a single long straight side chain is more effective in increasing the V.I. than a branched chain or several side chains; the latter structure causes an increase in viscosity; (5) the allocation of the side chain in the nucleus affects the viscosity, density and refractive index without affecting the V.I.; (6) Olefinic linkages in the side chain decrease the viscosity, but have only a small irregular effect on the V.I.; (7) the allocation of the cyclic nucleus within the molecule has little effect on the viscosity or V.I.; (8) long straight chain hydrocarbons give higher pour points than hydrocarbons of the same mol. wt. containing multiple or branched chains. J. W. H.

621.892.6

1212. Emulsion Cutting Oils. V. Parkhomenko. *Neft.*, 1936, **7**, 3, 25–26.—Water-soluble oils yielding a stable and thick emulsion (on adding water) were prepared from alkali sludge obtained in neutralizing acid-treated lubricating oils and adding spindle or other commercial oils. The mixture was prepared by treating the alkali sludge with 17° Be. NaOH, discarding the aqueous alkali sludge solution and mixing the organic layer with the oil at 50–60° C. till a semi-solid white mass was obtained, the latter being then used for cutting metals after dilution with water.

For. Petr. Techn.

665.521.5 : 665.543.061.5

1213. Solvent Dewaxing Process at Ponca City Refinery. J. C. Albright. *Refiner*, 1936, **15** (8), 287–292.—Describes the Bari-Sol unit of the Continental Oil Co. which operates on a slop wax distillate from the crude as charging stock. The double solvent–oil mixture (3 : 1) is chilled by indirect and direct means to − 10° to − 20° F., then centrifuged in a battery of 8 centrifuges giving 82% dewaxed oil and 18% petrolatum stock. The latter is diluted with more solvent (8 : 1), cooled to the same

temperature and re-run in a battery of 4 centrifuges giving 80% recovered oil (on re-run charge) which is blended with original charging stock for recycling and 20% petrolatum stock. The dewaxed oil and petrolatum are separated, treated in solvent recovery units to remove the solvent, especial attention being given to the drying of the solvent, otherwise the dewaxing efficiency is impaired. No data on the operation or the products are given. G. R. N.

665.521.5 : 665.543.061.5

1214. Gulf Treating Lubricating Stocks from Various Crudes in new Solvent Unit. G. Weber. *Oil & Gas J.*, 2.7.36, **35** (7), 30.—At Port Arthur refinery a Multi-Sol unit has been installed using furfural as the selective solvent. Various improvements have been incorporated in the plant, including an additional settling stage following the extraction, facilitating sharper separation of the two phases and allowing greater flexibility by recycling of the mixture to the extractor. Another improvement is the utilization of exchange heat in removing 40% of the solvent from the extract mixture in a furfural tower, relieving the extractor tower and stripper of a large share of the furfural removal. Heating of the two phases is accomplished in one furnace, the extract mixture passing through the radiant section and the raffinate through the convection section. A fan was installed at the entrance to the convection section to aid in adjusting the heat exchange to each mixture, but was not found necessary. The operation of the plant is clearly illustrated in a diagrammatic sketch and is described. Various types of stock have been treated in the plant. A paraffinic stock of 67 V.I. produced a raffinate of 103 V.I. Reductions in Conradson coke value from 0·08 to 0·02%, in sulphur content from 0·32 to 0·12%, in iodine number from 12·4 to 6·1 were effected by the treatment, and the colour was greatly improved. Viscosities of the charge, raffinate and extract S.U. at 100° F. were, respectively, 315, 203 and 2768 secs. Raffinates from naphthenic-type charges show similar improvements in these properties as compared with the charge, and the V.I. is raised from 31 to 67. R. A. E.

665.521.5 : 665.543.061.5

1215. Lubricating Oils. Solvent Extraction in a Reflux Extraction Unit. M. R. Cannon and M. R. Fenske. *Ind. Eng. Chem.*, 1936, **28**, 1035.—A solvent extraction unit employing reflux is described, and results for two methods of operation on a light oil of 95 V.I. are given, using acetone as the selective solvent. F. E. A. T.

665.521.5 : 665.545.3

1216. Liquid Propane. Use in Dewaxing, Deasphalting and Refining Heavy Oils. R. E. Wilson, P. C. Keith and R. E. Haylett. *Ind. Eng. Chem.*, 1936, **28**, 1065.—The paper gives a survey of the uses of liquid propane in the production of high-grade lubricating oils. The physical properties of liquid propane are discussed and shown to afford an explanation of the different properties of propane at different temperatures. In general, the paper is a summary of the many articles which have been published during the last few years on the application of liquid propane, and combines both a theoretical outline, with a short description of the better-known dewaxing and solvent-refining processes which employ this light hydrocarbon liquid. F. E. A. T.

665.521.5 : 665.545.3 : 608.3

1217. Patents on Lubricants. Alco Products Inc., F. W. Padgett and W. V. Stearns. E.P. 450,367, 16.7.36. Dewaxing of hydrocarbon oil using liquefied propane.

665.521.5 : 608.3

Bataafsche Petr. Mij. E.P. 450,511, 20.7.36. Refining of asphaltic oils using secondary or tertiary aliphatic alcohols.

665.521.5 : 665.543.061.5 : 608.3

E. B. Hjerpe and W. A. Gruse. U.S.P. 2,046,951, 7.7.36. Solvent extraction of lubricating oil using butyl lactate or *iso*propyl glycollate.

665.521.5 : 668.3

C. J. Rodman, M. Hecht and C. L. Jones. U.S.P. 2,047,157, 7.7.36. Removal of moisture and gases from lubricating oils by introducing into the oil an inert gas and spraying the oil containing the gas in a finely dispersed form into a vacuum to separate the gas and moisture. An anhydrous gas-free adsorbent material is then added to the oil which is afterwards filtered and the inert gas is added to the filtered oil.

665.521.5 : 668.3

M. R. Fenske and W. B. McCluer. U.S.P. 2,047,363, 14.7.36. Benzyl lactate is used for contacting lubricating oils containing components of different characteristics, to give two phases of lighter and darker colour.

665.521.5 : 665.543.061.5 : 668.3

W. B. McCluer and M. R. Fenske. U.S.P. 2,047,380, 14.7.36. Solvent extraction of lubricating oil using methyl salicylate.

665.521.5 : 665.545.3 : 668.3

H. H. Gross and W. V. Overbaugh. U.S.P. 2,047,412, 14.7.36. Dewaxing of lubricating oil using commercial methyl *iso*butylketone.

665.521.5 : 668.3

W. H. Volck. U.S.P. 2,047,755, 14.7.36. Treatment of petroleum oils or their distillates with acetone containing a small percentage of ammonia to produce mineral oils of high saturation.

665.521.5 : 668.3

V. Henny. U.S.P. 2,047,780, 14.7.36. Manufacture of lubricating oils by blending straight-run lubricating oil with a mildly oxidized lubricating oil derived from a liquid cracked residue.

665.521.5 : 665.545.3 : 668.3

C. M. Kellogg. U.S.P. 2,047,826, 14.7.36. Dewaxing of lubricating oil using as a selective solvent—acetone and a recycled kerosine extract of b.pt. below 300° and A.P.I. gravity not above 25°.

665.521.5 : 66.067.72 : 668.3

H. M. Weir. U.S.P. 2,047,985, 21.7.36. Process for controlling the decolorization of hydrocarbon oils.

665.521.5 : 665.545.3 : 668.3

U. B. Bray and D. E. Carr. U.S.P. 2,048,244, 21.7.36. Removal of wax from hydrocarbon oil using liquefied propane.

665.521.5 : 668.3

J. H. Shephard. U.S.P. 2,048,521, 21.7.36. Refining of lubricating oil using sulphuric acid, then neutralizing with ammonia without intermediate water-washing and extracting the neutralized oil with a selective solvent.

665.521.5 : 668.3

M. B. Chittick. U.S.P. 2,048,992, 28.7.36. Simultaneous refining of gasoline and production of low pour-point lubricating oil. Unrefined cracked gasoline is treated with aluminium chloride at 500° F., the gasoline distilled off and the residual oil treated with water, caustic soda and fuller's earth to produce a finished lubricating oil.

665.521.5 : 668.3

R. B. Day. U.S.P. 2,049,000, 28.7.36. Manufacture of asphalt and lubricating oils from liquid residues from cracking processes. The oil is digested at 550–850° F. under non-hydrogenation conditions and without substantial cracking—and then solvent treated.

665.521.5 : 608.3

A. M. McAfee and L. O. Crackett. U.S.P. 2,049,014, 28.7.36. Refining of lubricating oils by treatment with anhydrous aluminium chloride for 4–12 hrs. at 425–500° F.

665.521.5 : 665.545.3 : 608.3

A. M. Wilson. U.S.P. 2,049,036, 28.7.36. Dewaxing of lubricating oil using as solvent 75–90% by volume of secondary butyl acetate and 25–10% by volume of *iso*propyl alcohol.

665.521.5 : 665.545.3 : 608.3

U. B. Bray. U.S.P. 2,049,046, 28.7.36. Separation of asphalt and wax from oil using a solvent consisting chiefly of liquefied propane.

665.521.5 : 665.545.3 : 608.3

H. F. Goss and J. Opryshek. U.S.P. 2,049,059, 28.7.36. Dewaxing of hydrocarbon oil using acetone, benzole, alcohol, etc.

665.521.5 : 665.543.061.5 : 608.3

F. X. Govers. U.S.P. 2,049,060, 28.7.36. Solvent refining of lubricating oil using a mixture of aniline and amyl alcohol of boiling range 241–77° F.

665.521.5 : 665.545.3 : 608.3

C. F. Tears. U.S.P. 2,049,277, 28.7.36. Dewaxing of lubricating oil using liquefied propane.

665.521.5 : 608.3

S. S. Johnson, Jr. U.S.P. 2,050,329, 11.8.36. Separation of lubricating oil from a topped crude oil by vacuum distillation.

665.521.5 : 608.3

L. Liberthson. U.S.P. 2,050,345, 11.8.36. Refining lubricating oil first by acid treatment and extracting the oil from the mixture of hydrocarbon oil and sulphonic acids using dichloroethyl ether.

665.521.5 : 608.3

J. F. Wait. U.S.P. 2,050,772, 11.8.36. Stabilizing of lubricating oil by treating it with a mild oxidant at cracking temperatures, to form vapours of light portions and treating the oil residual to the vapours with alkali metal at 200–350° F. and under a vacuum.

665.521.5 : 608.3

D. K. Harger. U.S.P. 2,051,255, 18.8.36. Manufacture of green-bloom lubricating oils by treating cracked petroleum residue with acid, separating the sludge and subjecting the tar to vacuum distillation above 600° F. to remove substantially wax and the lighter components of the tar.

665.521.5 : 665.545.3 : 608.3

G. H. Anderson. U.S.P. 2,052,124, 25.8.36. Centrifugal separation of wax from a hydrocarbon oil which has been separated by chilling.

665.521.5 : 608.3

R. K. Stratford. U.S.P. 2,052,196, 25.8.36. Refining of lubricating oils with phenol at temperatures above 220° F. and below the temperature at which the phenol is completely miscible with the oil. W. S. E. C.

Wax.

665.521.6

1218. Composition of Petroleum Wax. B. J. Mair and S. T. Schicktanz. *Ind. Eng. Chem.*, 1936, **28**, 1056.—Three of the samples of wax prepared by Ferris, Cowles and Henderson from Mid-Continent crude by fractional crystallization with ethylene chloride of various narrow-boiling distillates, have been subjected to very accurate combustion analyses.

The results confirm the generally accepted conclusion that the higher melting fractions from each distillate are composed of normal paraffin hydrocarbons of the formula C_nH_{2n+2}, but also agree with the findings of Muller and Pilat that the fractions which melt about 30° C. below the corresponding normal paraffins are composed chiefly of cyclic hydrocarbons. F. E. A. T.

665.521.6 : 668.3

1219. Patents on Wax. J. M. Page, Jr. U.S.P. 2,048,513, 21.7.36. Recovery of wax of high m.pt. from a wax-cake containing oil and wax of high and low m.pts. by saturating the cake with $\beta\beta'$-dichlordiethyl ether and then sweating the cake in the presence of $\beta\beta'$-dichlordiethyl ether.

665.521.6 : 668.3

S. H. Diggs, R. E. Beard and J. M. Page, Jr. U.S.P. 2,050,428, 11.8.36. Method described of obtaining adhesive wax from Salt-Creek crude oil (m.pt. of wax 142–159° F.). W. S. E. C.

Fuel Oil.

662.753.31

1220. Tar as Fuel. J. G. King and C. M. Cawley. *J.I.P.T.*, 1936, **22**, 595–601.—A paper, presented for discussion, on the use of tar as fuel for external and internal combustion. G. R. N.

662.753.23

1221. Study of Fuel Oils. P. Woog, J. Givaudon, R. Sigwalt and others. *Ann. des Comb. Liq.*, 1936, **11**, 7–92, 209–259.—This comprehensive and extensive paper describes work, commenced in 1933 and completed in 1935, on fuel oils with particular attention to the following points: (1) complete solidification, *e.g.* as at the pour point and below; (2) sedimentation; (3) homogeneity and stratification effects; (4) effect of heat. In regard to (2), two courses are suggested; first, the elimination of material which may sediment by a light treatment with sulphuric acid or, secondly, the stabilization of the colloidal matter, *e.g.* by means of alkaline soap. The latter, which may be anhydrous alkaline oleate, palmitate, stearate, etc., can be introduced to the extent of less than one-half of 1% at temperatures of 190–200° C.; such treatment was not a complete success, however. The authors have experimented with the addition of small amounts ($\frac{1}{4}$–$\frac{1}{2}$%) of stearic acid to fuel oils which sediment appreciably on dilution with other oils. Some reduction in sedimentation is obtained, presumably by a peptizing effect of the stearic acid on the dispersed semi-colloidal matter.

The effect of heat upon some types of oil is to cause certain deposits. These are stated to be due to one of the following effects: (1) Precipitation of matter which is normally suspended in the fuel oil and, by reason of the latter's high viscosity at normal temperatures, does not precipitate, except very slowly, at normal temperatures. With increased temperature and diminished viscosity, this precipitation is rapid. (2) Increase in formation of heavy molecular agglomerates round colloidal carbon particles, caused by the increase in temperature, particularly above 50° C. W. E. J. B.

662.753.32

1222. Distillation with Soda. D. N. Bukh. *Azerb. Neft. Khoz.*, 1935, **7**, 104–109.—In accordance with lab. expts. and refinery scale treatment with solid Na_2CO_3 of a fuel oil in a Badger unit it is found satisfactory results can be obtained by using 50% less Na_2CO_3 when applying an aqueous solution instead of the solid reagent, while

the ash content of the final bottoms may be lowered by 23%. In the case of solid Na_2CO_3 the reaction begins in the heating equipment and it is highest in the zone of high temperatures, while with the aqueous solution the neutralization takes place below 100° C. The highest permissible concentration of Na_2CO_3 should be used to avoid bumping and contamination of the oil, and $NaHCO_3$ should be absent because of its lowering effect on the solubility of Na_2CO_3. The corrosion is lower when using the wet treatment since a more or less neutralized product is then passed through the heating equipment. For. Petr. Techn.

662.753.32

1223. Preliminary Study on Stability of Fuel Oils. M. Louis, R. Laurent and M. Metrot. *Ann. des Comb. Liq.*, 1936, **11**, 419–432.—The object of the work described in this paper was to determine the conditions under which a mixture of two fuel oils produces precipitation of asphaltic matter, etc., and to determine a method of forecasting such behaviour. This object has not, as yet, been attained, but the paper contains some interesting data on the hard asphalt content of various mixtures of fuel oils which were treated as follows. First, known mixtures were allowed to stand several months in tubes furnished with two outlets. From time to time samples of oil were withdrawn from the upper outlet until an almost constant hard asphalt content was reached. At this stage four 50-ml. samples of oil were withdrawn from the lower outlet and the hard asphalt determined. Various mixtures behaved differently. Some gave higher contents of hard asphalt than would be anticipated from the component oils, some gave less and one mixture showed an equal content. Other experiments involved a similar technique, but were carried out at 90° C. for various heating periods, whilst further experiments involved heating at 125° and 140° C. in crucibles. Of the oils studied, the greater the asphalt content, the greater the alterations caused by heat. Further work is planned. W. E. J. B.

662.753.32

1224. Ample Future Supply of Diesel Fuel Obtainable from Various Sources. W. H. Hubner and G. Egloff. *Nat. Petr. News*, 5.8.36, **28** (32), 25.—A comprehensive survey and analysis of the world's total automotive power plant is presented. It is shown, in the first place, that the known potential supply of petroleum has always been in excess of production. It is stated that if every automotive unit at present in use were to be converted to use diesel fuel then the petroleum industry could meet the demand for fuel. At present the average yield of gasoline from crude petroleum in the U.S.A. is 44·2% while that of gas-oil and diesel oil is 10·4%. The growth of the diesel engine appears to be somewhat slow, but steady, and, to a certain extent, limited at present. It is estimated that if all power plants, except passenger cars, were converted to use diesel fuel, gasoline would still be the chief source of automotive power. H. G.

662.753.32

1225. Testing of Fuels for High-Speed Diesel Engines. A. Hagemann and T. Hammerich. *J.I.P.T.*, 1936, **22**, 515–539.—A paper presented for discussion at the I.P.T. meeting in Holland giving details of tests on the filtering ability, the corrosive effect, the ignition quality, the coking effect and the smoking point of high-speed diesel fuels. G. R. N.

662.753.32(083.75)

1226. Diesel Fuel Specifications. C. H. Barton. *J.I.P.T.*, 1936, **22**, 508–514.—A paper presented for discussion at the I.P.T. meeting in Holland on the following diesel oil specifications, viscosity, ignition-quality fuel volatility, coke tests, sulphur content, pour point, ash and water content and calorific value. G. R. N.

662.753.32 : 621.43.019

1227. Investigation of Standard Specifications for Liquid Fuels suitable for Diesel Motors. E. Prévost. *Rev. Comb. Liq.*, 1936, **14** (133), 77–85.—In connection with production of specifications for diesel oils the A.S.T.M. has circularized 51 manu-

facturers, out of which 37 have given their suggested specifications, which were first classified into the following 3 groups: (1) high-speed motors over 1000 r.p.m.; (2) medium-speed motors 500–1000 r.p.m.; (3) low-speed motors under 500 r.p.m. Each group was further classified according to the shape of combustion chamber, and the method of injection. The specifications were then analyzed and the following classification for diesel fuels drawn up.

Classification of Fuels for Diesel Motors.

Quality.	Flash Point. P.M. °C.	Water and Sediment % Volume.	Viscosity in Seconds.				Conradson Carbon Residue % Weight.	Ash % Weight.	Pour Test °C.
			Saybolt U. at 100° F. (37·7° C.).		Saybolt Furol at 122° F. (50° C.).				
	Min.	Max.	Min.	Max.	Min.	Max.	Max.	Max.	Max.
No. 1D	46	0·05	32	50	—	—	0·2	0·02	1·66
3D	65·5	0·1	32	70	—	—	0·5	0·02	1·66
4D	65·5	0·6	—	250	—	—	3·0	0·04	1·6
4D	65·5	1·0	—	—	—	100	6·0	0·08	—
6D	65·5	2·0	—	—	100	300	—	—	—

The value of the various tests is discussed and an outline given of the indices to determine the ignition quality of fuels, *e.g.* Cetene Index, Diesel Index, etc.

M. M. L.

662.753.32 : 621.43.019

1228. Methods of Assessing the Ignition Quality of Diesel Fuels. F. H. Garner. *J.I.P.T.*, 1936, **22**, 503–507.—A paper which summarizes the more recent work on the rating of diesel fuels from the point of view of ignition quality and discusses such properties as aniline point, cetene number, etc., in this connection; 22 references.

G. R. N.

662.753.32 : 621.43.019

1229. Correlation of Tests on the Ignition Quality of Diesel Fuels. G. D. Boerlage, U. J. Broeze, L. J. Le Mesurier and R. Stansfield. *J.I.P.T.*, 1936, **22**, 455–468.—A paper presented for discussion at the I.P.T. meeting in Holland on the results obtained in testing several petroleum fuels in a number of engines at Delft and Sunbury and the correlation obtained thereby.

G. R. N.

662.753.32 : 621.43.019

1230. Measurement of the Quality of High-Speed Oil Engine Fuels. A. L. Bird and S. G. Bauer. *Engineering*, 1936, **142**, 164–166.—The ignition lag of diesel fuels is obtained by continuous observation of the crank angle at which the fuel injector opens and the angle at which the fuel begins to ignite. The injection is timed by the closing of a contact within the first 5% of the needle lift while the ignition time is taken from an ionization gap at a suitable point. When the flame reaches the gap, a discharge of a thyratron valve is started which lights up a neon lamp. This is observed stroboscopically as a band of light until the fuel injection valve again lifts, when the lamp circuit is shorted, putting out the discharge. The length and location of the dark space between the stop and start of the band of light in the stroboscope corresponds to the duration and timing of the ignition lag measured on a scale divided in degrees of crank angle. Fixing the end of the delay period at top dead centre, it is shown that ignition lag varies with load or amount of excess air, and with water jacket temperature. The application of the method for investigating the performance of fuels under various conditions are further described.

C. C.

662.753.32 : 668.3

1231. Patents on Fuel Oil. A. H. Calderwood and Shell Development Co. U.S.P. 2,048,371, 21.7.36. Production of sludge-stable fuel oil by diluting very heavy cracked residues (< 7° A.P.I. gravity) with a stove oil at 850° F. and under pressure to prevent the separation of light oil components. The hot blended oil is then steam distilled to remove light components, leaving a blended oil of gravity > 10° A.P.I.
W. S. E. C.

Asphalt and Bitumen.

665.45

1232. Identification and Detection, in Mixtures, of Bituminous Materials. E. J. Fischer. *Asphalt u. Teer*, 1936, **36**, 24–25, 463–464, 484–486.—This paper describes methods for the identification of bitumen and allied substances and their detection in mixtures. The materials covered are natural asphalts, petroleum asphalts and pitches, steam coal, brown coal, wood, bone, oil, gas and animal tar pitches, and woolfat, resin, montan wax, and naphthalene pitches, and chemo-asphalts and pitches.
A. O.

665.45

1233. Consistency of Concentrated Suspensions. R. N. Traxler. *Ind. Eng. Chem.*, 1936, **28**, 1011.—The consistency of suspensions is discussed, in which the concentration of the disperse phase is so great that the particles are in some state of packing. The theory is illustrated by data obtained from systems composed of mineral powders dispersed in asphalt and of asphalt dispersed in aqueous soap solution. It is shown that when the phase volume is maintained constant, a decrease in particle size is accompanied by an increase in consistency; and further that particles possessing a narrow-size distribution produce a greater increase in consistency than particles of wide-size distribution.
J. W. H.

665.521.8 : 539.61

1234. Adhesivity of Cutback Bitumens. D. W. Geissler and H. Kleinert. *Asphalt u. Teer*, 1936, **36**, 481–483, 500–503, 533–538.—An account is given of investigations in connection with adhesivity of cutback bitumens. A series of typical commercial cutbacks were selected and examined according to D.I.N. methods, mixtures were then prepared with various aggregates and rate of evaporation of solvent and effect of evaporation on adhesivity, using Dresden method, determined. A comparison was made of the Dresden and D.I.N.–U. 37 adhesivity tests and, owing to discrepancies, a third method was examined. The latter consisted in preparing 7 cm. cubes with mixtures of cutback and aggregate of specified grading, the cubes were dried for 5 days, soaked in water for 6 days, then disintegrated and placed in cylinders, after which water was added and the cylinders shaken. The adhesivity was estimated by the degree of turbidity of the water, and results were found to compare with those of Dresden method. The effect of tar oil was investigated by examining adhesivity of cutbacks prepared with bitumen and creosote and various fractions and mixtures of the latter. Residue from creosote gave marked improvement in adhesivity, and effect of heating cutbacks was, therefore, examined by tests on aggregates coated with A.S.T.M. volatility residues. These tests confirmed in most cases that adhesivity is improved by heating cutbacks.

Exposure of coated aggregates for a long time was found to have no influence on adhesivity. The authors conclude that the solvent used in most cutbacks is of coal-tar origin, evaporation of solvent is complete in about 35 days and approximately half the solvent remains in the beaker. Most cutbacks have good adhesion to hydrophobic stone and poor adhesion to hydrophillic stone.

Materials such as creosote contain high molecular water-insoluble constituents which react with the stone and improve adhesion.
A. O.

665.521.8 : 66.067.1

1235. Adsorption of Bitumen and its Constituents by Earths. H. T. Lorne. *J.I.P.T.*, 1936, **22**, 541–561.—A discussion of the relative efficiency of the adsorbent capacity

and the surface area per unit volume with reference to the efficiency of fillers, together with an account of experiments on the irreversible adsorption that takes place when decolorizing tests are carried out on solutions of bitumen, asphaltenes, etc., in carbon disulphide. G. R. N.

Special Products.

547.53 : 66.094.403

1236. Continuous Chlorination of Benzene in the Liquid Phase. N. N. Vorizhtzov, G. B. Zil'berman and V. M. Grigor'ev. *J. Appl. Chem. U.S.S.R.*, 1935, **8**, 872–883.—It was found that benzene gave the highest yield of *mono*chlorbenzene when using a Cl_2 mixture containing 20% air and passing it in the same direction with benzene through reaction vessels packed with iron Raschig rings intermixed with glass rings at a ratio of 8–8·5 litres chlorine and 250 ml. benzene at 38° C. In recycling the chlorinated benzene yields of up to 77·2% *mono*chlorbenzene and 12% *poly*chlorbenzene were reached. Both reagents were admitted through the lower part of the reaction vessel. A counter-current method did not improve the yield, while the highest yields were obtained when having the vessel always filled with benzene.
For. Petr. Techn.

66.062.2

1237. Varnish Thinners. H. W. Chatfield. *Paint Manufacture*, August 1936 (6), 254–256.—The properties and uses of various thinners are discussed. Turpentine once the only varnish thinner has now been largely replaced by white spirit. Cymene, cumene, dipentene and pine oil have all been suggested for this purpose.

White spirit is the most widely used thinner, being also extensively used for metal polishes, wax polishes and as a carrier for toxic substances in insecticides. It is inferior to turpentine in solvent power, evaporation rate, etc., but is more readily available, cheaper, has a more permanent colour and can be stored unchanged.

Other petroleum products used in the varnish industry include benzine, kerosine, light distillates, wax, fuel oil and asphalt.

Benzine is used largely in black and yellow insulating varnishes while kerosine is employed in high-temperature stoving finishes. Light distillates find a successful use in insecticides.

Benzole is rarely encountered in varnishes, but is often met with in paint and varnish removers.

Petroleum products are now assuming importance as substitutes for coal-tar solvents, and fractions made from Borneo crudes have been substituted for benzole, toluol and xylol. Hydrogenated naphthas made by hydrogenating certain gas oils are also coming into use. The article closes with a consideration of decalin and tetralin as thinners. D. L. S.

632.951

1238. Speed of Action of Household Sprays. D. F. Murphy and G. B. Vandenberg. *Ind. Eng. Chem.*, 1936, **28**, 1117.—The speed of knockdown (*i.e.* the speed of paralysis) of an insect is almost as important as the killing power. Using the Peet–Grady equipment, comparative speeds of knockdown are given for solutions of Lethane 384 (50% concentration of β-butoxy, β'-thiocyano *di*ethyl ether), rotenone and pyrethrum in a petroleum distillate. The speed of knockdown of a 1% solution of Lethane 384 is greater than can be obtained with pyrethrum or rotenone. Further, the substitution of part of the pyrethrum or rotenone by a relatively small percentage of Lethane 384 greatly increases the speed of knockdown and the killing power.
J. W. H.

661.763

1239. Carbon Blacks from Benzene and Naphthalene. Anon. *Chem. Trade J.*, 28.8.36, **99**, 170.—According to E.P. 450,876 of 1935 the I.G. Farbenindustrie have found that carbon black having very valuable properties is obtained by decomposing monocyclic hydrocarbons at temperatures preferably from 400 to 500° C. in the presence of catalysts having a dehydrogenating action under increased pressure, the working

conditions being such that the black formed is not exposed to temperatures above 500° C. for long periods of time. Catalysts are finely divided metals of the 8th group, in particular metals of the iron group and activating substances are the difficultly reducible oxides of the elements Ti, Cr, Mo, W, Mn, V and Bi. Boric acid may also be used. Pressures of 50–100 atm. seem to be most suitable. In practice, when working rapidly, an almost complete decomposition into carbon and hydrogen is obtained, while working slowly, *e.g.* with catalyst of slight activity, the hydrogen first formed reacts with carbon to form methane, especially under pressure. Similarly polynuclear aromatic hydrocarbons and compounds or their derivatives or hydrogenation products or mixtures thereof may be treated for production of black. Examples given are: (1) 100 parts benzene and 5 parts of nickel reduced from the carbonate precipitated on pumice are heated to 400–450° C. under a pressure of 50–60 atm. in a rotary autoclave; (2) 100 parts naphthalene are heated in a rotary autoclave with 10 parts finely divided nickel to which NaOH has been added at 450–480° C. until the pressure no longer increases. The catalyst is removed from the black by treatment with dilute acid. The carbon black produced is suitable for the purposes of the rubber industry and for preparation of printing inks. R. A. E.

661.763

1240. Carbon Black from Monoxide. Anon. *Chem. Trade J.*, 21.8.36, **99**, 153.—At a recent meeting of the Belgian Association of Rubber Industry Technologists, Dr. Oostven discussed the production and properties of a carbon black known as "Carbonalpha." It is obtained from CO with the aid of catalysts which promote towards the right the equilibrium reaction $2CO = C + CO_2 + 39{,}000$ cal. At the most suitable working pressures the monoxide is transformed into carbon and the dioxide at low temperatures, whilst at high temperatures the dioxide is reduced by carbon. In the process developed the dioxide is reconverted into CO and the quantity of fuel consumed reduced to about the equivalent of black manufactured. The low temperatures are favourable from the point of view of quality of product. The ash content of the black is high (6·56% in one analysis) owing to the difficulty of removing the residue of the catalyst employed. X-ray analysis has shown that speed of "graphitization" of a carbon increases with temperature. Thorough purification of the CO used is essential to the process, but several systems have been found practicable for the purpose. Practical trials in the rubber industry are stated to have given results favourable to "Carbonalpha" in comparison with a number of standard American carbon blacks and lamp blacks. R. A. E.

665.521.4 : 66.092

1241. Pyrolysis of Gas-Oil. V. F. Gerr and A. V. Kudinov. *Azerb. Neft. Khoz.*, 1935, **7**, 119–125.—To obtain the highest toluene yields, paraffin-base gas-oil should be cracked at about 750° C., and naphthene-base gas-oil at about 700° C. When lowering the content of fractions (in the gas-oil) boiling below 300° C. from 64–5% there is observed a 150% increase in coke and a decrease in yield of toluene by 0·2–0·6% (on the stock). For. Petr. Techn.

665.521.4 : 66.094.3

1242. Preparation of Hydroxy Acids by Oxidation of Gas-Oil. A. K. Plisov, V. P. Golendeev and A. I. Zel'tzburg. *For. Petr. Techn.*, 1936, **4**, 237–243.—Hydroxy acids, *i.e.* petroleum ether insoluble acids obtained in the oxidation of hydrocarbons, have been found suitable for the manufacture of plastic masses besides being useful as film-forming compounds in the lacquer and pigment industries. To obtain a maximum yield of these substances the authors oxidized Markop gas-oil with air at 115–120° C. in the presence of sodium or calcium naphthenate catalyst and in the absence of steam in a special apparatus consisting of a ring-packed slightly-inclined glass tube, 4 m. long. The acids so produced contained 80–85% hydroxy acids, which were separated by extraction with hot caustic soda, then petroleum ether. These acids had an acid number of 150–160 and a saponification number of 280–290.
G. R. N.

665.521.9

1243. Utilization of Petroleum Coke. D. G. Jones. *Refiner*, 1936, **15**, 280–281.—A compilation of some of the purposes for which petroleum coke is suited. Uses, that are discussed, include fuel, pulverized, colloidal and briquette types, electrodes, carbon brushes, cell fillers, building bricks, metallurgical reducing agent and activated carbon. 37 references are given. G. R. N.

667.624.6

1244. Anti-Corrosive Paints. Part I. E. Assheton. *Paint Manufacture*, August 1936 (6), 242–244.—This article deals with the prevention of corrosion of iron and steel, and two types of rust-preventing paints are discussed: (1) non-drying grease paints; (2) drying paints. The former may be subdivided into paints required for permanent protection and those required for temporary protection only.

Paints for temporary protection must be easily removable when desired, and a popular compound in this class is a solution of lanolin in white spirit.

The permanent non-drying paints require great care in manufacture. They must be finished in such a manner that they may be applied to a vertical surface and not run under the influence of summer heat. Their main disadvantage is that as the surface is always greasy they cannot be used on iron-work with which human beings or animals come in contact.

With regard to drying paints there is great disagreement as to the efficiency or otherwise of various pigments and media offered for the protection of iron- and steel-work against corrosion. No paint has yet been formulated which will provide permanent protection.

The earliest paints of this class were a coating of coal-tar in a suitable solvent. They were, however, very inefficient and, besides tending to run badly in the summer heat, could not be painted over. Petroleum pitch has been substituted, but all these materials crack and allow the ingress of moisture.

Until lately the only medium used for these paints was linseed oil. Latterly with the advent of oil-soluble phenolformaldehyde rosin-modified synthetic resins, wood oil has come into prominence. A varnish made from 3 parts of wood oil to 1 part of 100% phenolic resin shows remarkable resistance to water, and suitably pigmented has shown a great resistance to corrosion when applied to iron and steel. A better medium than wood oil is a mixture of this with linseed oil. D. L. S.

547.261 : 608.3

1245. Patents on Special Products. J. Y. Johnson. E.P. 448,898, 17.6.36. Purification of crude methanol by supplying the crude methanol and water to a rapidly rotating centrifuge and separating, after thoroughly mixing, the oily layer formed from the lower layer. The methanol is fractionally distilled.

546.22 : 608.3

J. Y. Johnson. E.P. 449,911, 7.7.36. Recovery of sulphur from masses containing it together with tarry or bituminous substances, by vapour-phase treatment in the presence of methylene or ethylene chloride, chloroform or mixtures of these. The extract is separated from the mass, and the sulphur is separated from the extract by cooling.

661.851 : 608.3

W. W. Triggs. E.P. 450,152, 6.7.36. Manufacture of tetra-alkyl lead.

547.26 : 608.3

I.G. Co. E.P. 450,218, 9.7.36. Preparation of high-molecular sulphur-containing condensation products by reacting alkaline, alkaline earth or ammonium polysulphide on acetals from β-chloroethyl alcohol. The reaction is carried out in the presence of water.

661.763 : 608.3

W. B. Wiegrand. E.P. 450,450, 8.7.36. Modification of the usual channel process for the production of carbon black by omitting the use of the deposition burners

adjacent to the scraper blades and heating the product in an oxidizing atmosphere above 300° C. The carbon black produced has an improved colour value and is particularly suitable for use in the manufacture of paints, lacquers, inks, plastics, etc.

546.22 : 608.3

J. Y. Johnson. E.P. 450,559, 21.7.36. Preparation of organic sulphur compounds by the action of vinyl sulphones on bisulphites of light metals.

66.063.6 : 608.3

J. W. Orelup. E.P. 450,672, 17.7.36. Wetting, dispersing or emulsifying agents are prepared by condensing a fatty acid containing 10–18 carbon atoms in the molecule, with monoethanolamine, condensing the product and sulphating it at 30–35° C. with sulphuric acid monohydrate.

668.736.32 : 608.3

J. Y. Johnson. E.P. 450,716, 23.7.36. Recovery of phenols from waste aqueous liquors by mixing them with tricresyl phosphate in the presence of inert gases. A foam is formed and the mixture is allowed to stratify by sedimentation; the phenol-laden phosphate is withdrawn.

615.778.7 : 608.3

A. R. White. E.P. 450,717, 23.7.36. A disinfectant or deodorant is prepared by mixing 10% of a 40% solution of formaldehyde, 5% of a solution of sodium meta-silicate, 1% of a soap solution, 1% of an aromatic oil and approximately 85% of water.

668.736.32 : 608.3

H. E. Potts. E.P. 450,789, 24.7.36. Removal of phenols from aqueous liquors by extracting the liquors with hydrogenated oils of volatility range 200–300° C.

66.062 : 608.3

P. B. Renfrew and L. E. Marsh. U.S.P. 2,048,140, 21.7.36. Reclaiming absorption oil by treating the liquid solvent with a monobasic alkali in a treating zone maintained at 340–70° F. through which air and steam are passed. The desirable portion of the contaminated solvent is vaporized and condensed to separate the solvent from the water resulting from the condensation system. W. S. E. C.

Engines.

621.385.83

1246. Utilization of Cathode Ray Tube for Indicator Diagrams. R. Vichnievsky. *Ann. des Comb. Liq.*, 1936, **11**, 127–149.—The method employed is as follows: A pencil of light, emitted by a continuous source, is allowed to fall, in the form of a slightly convergent beam, upon a thick diaphragm. The latter is subject to engine pressure and its deformations under engine operation change the incident beam from slightly convergent to divergent. Thus according to the vibrations of the diaphragm, the density of light flux across the beam also varies. In the path of the reflected beam, a photo-electric cell is arranged, and so the variation in light flux is translated into a varying photo-electric current. The latter is fed to a large resistance (several megohms) and so a varying potential is set up, which after suitable amplification is fed to the vertical deflecting plates of a cathode ray tube. Thus the vertical deflection of the spot corresponds to the pressure changes in the cylinder. A somewhat similar arrangement is used to impart horizontal motion to the spot. In this case a cam of special design (spiral) is turned at crankshaft speed before a narrow slit which is illuminated continuously. The position of the cam controls the amount of light which passes the slit and falls upon a second photo-electric cell.

The electrical variations in potential set up in the circuit are fed to the horizontal deflecting plates of the tube, and so an indicator diagram is obtained. Various methods of overcoming distortion effects are described. The paper contains many

photographs of the type of diagram obtained from an 8 h.p. Renault engine, operating at 3500 to 4000 r.p.m. Certain diagrams, taken on the C.F.R. engine, indicate pressure oscillation during the expansion stroke of a period of about 2500/sec. The amplitude of this vibration was related to the compression pressure and was found to be a maximum when the compression ratio was between 8 and 9 : 1, working with a given fuel. W. E. J. B.

621.431.75

1247. Liquid-Cooled Aero Engines. H. Wood. *J.S.A.E.*, 1936, **39**, 267–286.—The first part of this paper is a brief history of the development of the Rolls-Royce Kestrel engine. In addition to a description of the basic design of the engine itself the author gives particulars of the performance of the various sub-types of the Kestrel and shows graphically the progress made in crankshaft speeds, compression ratio, servicing period, B.M.E.P., and weight per B.H.P. during the nine years in which the engine has been in production. Details are also given of the performance of the engine on high duty as approved by the Air Ministry. In this part of the paper the author also gives some particulars of the Merlin engine and the " R " type which won the Schneider Trophy in 1931. It is estimated that by 1940 the requirements of high-speed military aircraft will be at least 1600 H.P. per unit and a table is given imagining engines of this output operating at 3000 ft. per min. piston speed, and 170 lb. per sq. in. M.E.P., varying only the number of cylinders, bore and stroke, r.p.m., etc. The various problems involved including engine form, fuels, detonation, waste heat disposal, cooling drag, cooling medium, etc., are dealt with at length.

The author's main conclusions regarding probable future trend of design are as follows : Increase in compression ratios and speed will necessitate a decrease in bore and stroke and the adoption of the sleeve valve may be necessary. Design will probably tend towards multi-throw crankshafts with more than two pistons per crank-pin. Liquid cooling will be necessary in order to cope with increased waste heat and the cooling medium will be operated at high temperature to limit cooling drag. More exact methods of assessing knock ratings are necessary in order to be able to predict accurately the behaviour of a fuel in the actual aero engine.

C. H. S.

621.43—631.2

1248. Limitations to the Practical Use of More Volatile Motor Fuels. W. G. Lovell. *Nat. Petr. News*, 27.5.36, **28** (22), 37.—Since the average automobile engine has been designed to run on the average fuel, the use of fuels of greater volatility does not result in appreciable advantage unless the appropriate modifications to the engine are made. The extent to which the appropriate modifications can be made are limited by two factors : (*a*) the appearance of the vehicle, which is governed by fashion ; (*b*) natural conditions as manifest in changing atmospheric temperature and altitude. Advantage may be taken of extra volatility simply by reducing the mixture temperature and adjusting the carburettor. Mixture temperature may be reduced by : (*a*) reducing the air intake temperature ; (*b*) insulating the manifold ; (*c*) increasing the amount of heat absorbed in evaporating the fuel. Prevailing atmospheric temperature is the limit of (*a*) unless refrigerating apparatus is installed. Under (*b*) a maximum reduction of 20° F. is to be expected, (*c*) is a function of the volatility of the fuel and, therefore, of barometric pressure and 5–10° F. is apparently the maximum advantage to be obtained under optimum conditions. The optimum conditions applying under heading (*a*) and (*b*) depend on (*c*) and must therefore be altered when (*c*) is altered, and the maximum advantage to be gained is therefore limited by the degree of flexibility possessed by the particular engine. The alternative is continual adjustments which at present cannot be made automatic and which the average driver cannot or will not make. H. G.

621.43—631.2

1249. Automotive Design Changes, their Relation to Modern Motor Fuels. W. G. Lovell. *Oil & Gas J.*, 25.6.36, **35** (6), 58.—Discussing G. G. Brown's paper at the meeting of the Natural Gasoline Association, the author pointed out that the adaptation of cars to use fuels of extremely high vapour pressure is by no means simple or

cheap. Much research has been carried out on the problem of handling fuels of moderately high vapour pressure and some cars now have external fuel lines, larger fuel pumps and other safety devices. Car style sometimes makes such modifications difficult and expensive.

In order to utilize the potential advantage of fuels of greater over-all volatility, it is necessary to reduce the mixture temperature. Assuming seasonal changes in volatility of gasoline to take care of extreme seasonal changes of temperature, it is still necessary to ensure that day to day variations of temperature do not affect performance. It is thus necessary to fit a thermostat. Practical considerations, therefore, limit the amount by which mixture temperatures can theoretically be reduced by about half. A further difficulty is that the car designer must build cars which will operate satisfactorily on gasoline of the poorest volatility marketed. If mixture temperatures were appreciably reduced to suit more volatile gasolines, then the car would not operate satisfactorily on the fuels of low volatility. Assuming that a mixture temperature control were provided, there is no satisfactory volatility index classification in commercial use to guide the driver in adjusting his car to suit the fuel purchased. It is suggested that provision of more uniform fuels or classifications of fuels, would assist progress in the utilization of the potential value of fuels to the best advantage. R. A. E.

621.43—634.2

1250. Engine Types and Requirements for Preparation of Fuels. F. C. Mock. *J.S.A.E.*, 1936, **39**, 257–264.—Fuels for modern high-speed automotive engines are divided by the author into five classes according to their volatility, as follows:—Fuels boiling below 280° F.; from 140° to 360° F.; from 200° to 450° F.; from 300° to 560° F.; and above 560° F. Preparation of the charge for combustion in any engine must ensure that the fuel be vaporized or in a similarly small order of sub-division before ignition, and the fuel and air must be intimately mixed. The problems involved in dealing with each class of fuel are dealt with and many suggestions arising from practical experience are put forward for dealing with these problems. Much information is given regarding fuel injection for spark ignition engines which includes details of a recommended design for fuel injection into supercharger. Regarding C.I. engines the author shows by means of graphs how the compression temperatures are raised and pressures lowered by throttling.

The conclusion is reached that fuel injection in one form or another is an absolute necessity for further development of the aircraft engine. C. H. S.

621.43—634.2

1251. Design of Fuel Injectors for Diesel Engines. G. J. Lugt. *J.I.P.T.*, 1936, **22**, 486–502.—A paper presented for discussion at the I.P.T. meeting in Holland on some principles of injector design together with an illustrated account of some well-known makes. G. R. N.

621.43—634.2 : 621.431.72

1252. Diesel Electric Traction on the Netherlands Railways. W. Hupkes. *J.I.P.T.*, 1936, **22**, 469–485.—A paper presented for discussion at the I.P.T. meeting in Holland dealing with the general arrangement, bogie and car details, motive power, cab equipment, automatic coupler, brakes, and heating, and ventilating of diesel electric trains operating on the Dutch railways. G. R. N.

Detonation.

621.43.016

1253. Relation between Spontaneous Ignition Temperature and Anti-Detonation Quality. I. R. Rosenau. *Mon. Petr. Roum.*, 1936, **37**, 1021–1023.—The author has determined the spontaneous ignition temperatures and octane numbers of several gasolines. The method of determining the octane numbers is not stated, but the Moore apparatus was used for the spontaneous ignition temperatures. Typical results are:—S.I.T.'s, 279, 290, 296, 302° C.; Corresponding Octane Numbers, 58, 67, 74, 78.

The author believes that a good correlation exists between the two properties, which eventually may be established, and so the detonating quality obtained via a determination of S.I.T. W. E. J. B.

621.43.019.4

1254. Research on the Detonation of Gaseous Mixtures. J. Breton. *Ann. des Comb. Liq.*, 1936, **11**, 487–546.—The author has adapted a photographic method for the measurement of the speed of the explosion waves and so determined the detonation limits of several gas mixtures. The apparatus used is described in detail and amongst the mixtures studied were hydrogen and oxygen; carbon monoxide and oxygen; carbon monoxide, hydrogen and oxygen, hydrogen and air; hydrogen, carbon monoxide, and air; ammonia and oxygen; propane and oxygen; *iso*butane and oxygen; acetylene and oxygen; acetylene and air; ether and oxygen; ether and air.

The author discusses the influence of certain factors on the detonation limits of explosions in general and gives also curves for each of the above mixtures showing the explosion wave velocity against composition of the mixture. These speeds were all between 1000 and 4000 metres/sec., and the highest values were obtained always with "rich" mixtures. With oxygen and hydrogen mixtures, *e.g.* the highest speeds are obtained when 90% hydrogen is present. In most cases the curve of speed against composition is regular in character, sensibly straight for the most part but with curved portions at each extremity, indicating reduced speeds at these points. In the cases of ammonia–oxygen mixtures, however, increased speed is observed at the limits of composition. Acetylene mixed with air or oxygen is unusual in that the curve exhibits a maximum and a minimum between each limit.

In the case of hydrogen mixed with air or oxygen, an increase in initial pressure causes an increase in the range of the upper and lower explosion limits. Hydrogen has a pro-detonating effect on carbon monoxide–oxygen mixtures as the addition of small quantities of hydrogen lowers the lower detonation limit considerably. The explosion wave which is set up when the gas composition approaches the limiting values is always helicoidal.

The article contains several photographs of explosion waves. W. E. J. B.

Coal.

662.742

1255. Liquid Fuel from Coal by Low-Temperature Carbonization. W. A. Bristow. *J.I.P.T.*, 1936, **221**, 583–594.—A paper, presented for discussion, on the Coalite process of low-temperature carbonization and giving complete specifications of the products obtained. G. R. N.

662.742

1256. Coal as a Source of Liquid Fuel. R. Lessing. *J.I.P.T.*, 1936, **22**, 577–582.—A paper, presented for discussion, emphasizing the need for more fundamental research on the constitution of coal. G. R. N.

665.581.5(410)

1257. Coal-Oil Production in Great Britain. Anon. *Petr. Times*, 29.8.36, **36**, 271.—Data abstracted from the 1935 report of the Secretary for Mines is presented. During 1935 the total production, in millions of gallons, of light oils from coal and coal products, was 79, of which 66 were motor spirit. These figures compare with 50 and 40 respectively for 1934. The Scottish Shale Oil industry produced 10,200,000 gallons in 1935. Coke ovens were the largest contributors of motor spirit, supplying 26,250,000 gallons, while the coal hydrogenation plants supplied 20,775,000 gallons. The total production of creosote and heavy oils in 1935 was 93 million gallons, an increase of 3 million gallons over 1934. It is estimated that the imposition of the import duty on petroleum has resulted in an increase in the annual consumption of coal of 1,428,000 tons. The output from low-temperature carbonization plants shows a steady increase, while the yield of crude spirit per ton of coal has also increased. Particulars con-

erning the hydrogenation plant at Billingham show that this plant produced 33 million gallons of motor spirit up to May 1936. 411,500 tons of coal were treated. H. G.

66.061.4 : 608.3

1258. **Patents on Coal.** C. D. Lowry, Jr. U.S.P. 2,049,013, 28.7.36. Extraction of hydrocarbons from coal to produce motor spirit using a solvent such as furfural or benzole at elevated temperatures and pressures. The hydrocarbon extract is removed and a portion of the solvent vaporized and the extract is then cracked in the presence of the unvaporized portion of the solvent. W. S. E. C.

REVIEWS AND BOOKS RECEIVED.

Reviews.

625.85(02)

ASPHALT ROADS. P. E. Spielmann and A. C. Hughes. Pp. x, 319. 1936, Edward Arnold & Co., London. 25*s*.

This volume, which is the fifth of the series of publications known as the Road-makers' Library, treats very fully the subject of asphalt road surfacings.

The work is divided into five parts, comprising an historical introduction and sections dealing with asphaltic bitumen and natural asphalt, bitumen mixtures, asphalt, and analysis and testing; the book is completed by appendices containing much useful information and an extensive bibliography and subject and author index.

The introduction, although brief, makes interesting reading dealing with the discovery and development of the various rock and natural asphalts.

In part 2 a summary is given of the literature in connection with the origin, nomenclature, constitution and properties of asphaltic bitumen and natural asphalts. In this section is discussed, in addition to the more usual physical and chemical properties, the work of Richardson, Marcusson, Nellensteyn, and others in connection with the constitution and analysis of bitumen, the various theories put forward concerning adhesion and surface tension, and the effect of blowing on the properties of bitumen. Mention is also made of the uncertainty existing with regard to the effect of wax in bitumen and the difficulties attending its estimation, and also of the confusion surrounding the question of viscosity.

Part 2 also contains much valuable information concerning natural asphalts, and the tables showing the composition and properties of the various asphalts will be especially useful. In discussing bituminous binders for use in surface dressing, bituminous macadam and light carpet mixture, the authors imply that it is not possible to obtain a binder which is entirely satisfactory, whereas in fact practical experience over a number of years has shown that no very great difficulty is encountered with most types of stone.

The subject of tar–bitumen mixtures is dealt with in part 3, the effects of addition of tar to bitumen and *vice versa* being considered and methods of analysis of such mixtures discussed. Brief reference is also made to rubber–asphalt mixtures in this section.

In part 4, the subject of asphalt surfacing has been very fully and admirably treated, and all of the various types of asphalt surfacing are discussed. In addition, considerable space is devoted to the consideration of road stones, filler, and filler–bitumen relationships, etc. This section is concluded with a discussion of plant and tools and of the various defects which may develop in asphalt surfacings.

Analysis and testing is considered from the point of view of the chemist in the field, in part 5, while a list of suitable equipment for a field laboratory is given in Appendix I.

The book as a whole is very well written, and while much of the subject-matter will probably not meet with universal agreement, it will be of the greatest value and interest to all concerned with the industry. A. OSBORN.

665.43(02)

OZOKERIT UND VERWANDTE STOFFE. Dipl.-Ing. Leo Ivanovszky. In three parts, obtainable separately. Vol. I.—Raw materials and technology of industries using waxes, with special reference to ozokerite. Pp. xvi, 192. R.M. 7; Vol. II.—Part 1. Mineral waxes: occurrence, production, refining, and testing. Pp. xviii, 360. R.M. 13; Vol. II.—Part 2. Synthetic waxes; natural and hydrocarbon waxes: analytical data. Pp. xi, 124. R.M. 7. 1936, A. Hartleben's Verlag, Vienna and Leipzig.

Despite the inclusive form of title, the reader of this treatise is left somewhat unprepared for the wide scope of the text. Ozokerite is indeed the focal point of the work as a whole—its treatment in Vol. II (Part 1) should in fact rank as a standard authority—but Ing. Ivanovszky has recognized that this material and its raffinate are generally used and frequently sold only in conjunction with other materials. The technical behaviour of such mixtures often departs widely from that of the constituents. In order to have practical significance a study of ozokerite must include the relationships toward a number of other products, the most important of which are waxes of all kinds and solvents.

Accordingly, in Vol. I the author prepares the way with a general description of all substances which for technical purposes are classed as waxes. He groups them according to origin—mineral, natural and synthetic—and deals too with mixed waxes, which are not well covered by existing books except, possibly, from the analytical standpoint. Physical properties such as hardness, stability to heat, and the effect of solvents are, for most wax uses, the real criteria.

Some years ago the author discovered that the evaporation of solvent from a wax/solvent paste is controlled by the "Retention" of the wax, a property which is characteristic and expressible in figures. From time to time, as the subject was further developed, Ivanovszky published his results in journals which, unfortunately, have not been easily accessible in England. A valuable feature of the new book is that all the main results of this original work have been collected and clearly explained. A section is devoted to solvents commonly used in polish making and similar industries, and includes petroleum distillates.

The first part of Vol. II embodies the main theme of the whole book. The production of ozokerite, its raffinate and the numerous commercial qualities are described with completeness and in detail. It is evident that the author's first-hand experience of the mineral is extensive. Sufficient is said concerning the manufacture of paraffin wax and petrolatum to illustrate general principles.

The petroleum technologist will probably find that this region of the book is chiefly interesting for the 120 odd pages given to hydrocarbon waxes, their chemistry and properties. This section is compiled largely from literature and is vitalized by Ivanovszky's own experiences and comment. Prominence is given to physical constants such as viscosity and refractivity.

In recent years much progress has been made in the synthesis of wax-like substances in which the essential properties of the natural waxes can be reproduced and controlled. Volume II, Part 2, breaks new ground in giving a connected account of the principles and technique of the subject, chiefly as revealed by patent literature. The use of petroleum wax as a raw material for wax synthesis is of special interest.

The book as a whole abounds in ingenious graphs and useful tables. The text, which is otherwise arranged rationally, is made rather hard to read by numerous lengthy footnotes and, in places, by paragraphs congested with data. In the reviewer's opinion the use of Gothic type does not make a complex work of this kind the more readable.

The subject-matter itself, however, in its completeness and originality of treatment makes the book indispensable to users of waxes, and provides the petroleum industry with a reference work to a field in which literature has hitherto been difficult of access and rather scattered.

P. G. Higgs.

Books Received.

6(059)

Imperial College of Science and Technology, Calendar 1936–37. 572 pp.

Part I contains such information concerning regulations, courses of study, scholarships, etc., as is necessary for intending students.

Part II contains the terms of the College Charter, an historical account of the development of the College, lists of scholarship holders, prizewinners, diplomates, associates, etc.

62

IRON AND STEEL INSTITUTE, JOURNAL No. I, 1936. VOL. 133. Proceedings, pp. 1–501; Abstracts, pp. 1–256.

Contains thirteen Papers presented at the Annual Meeting of the Iron and Steel Institute held in London on May 7th and 8th, 1936, together with Abstracts on iron and steel and kindred subjects.

U.S. Geological Survey:

55(787)

BULL. 867. GEOLOGY OF THE COASTAL PLAIN OF SOUTH CAROLINA. C. Wythe Cooke. Pp. v, 196. 1936, Superintendent of Documents, Washington, D.C. 60 cents.

The area covered in this bulletin extends inland from the Atlantic Ocean for a distance of 120 to 150 miles, and occupies more than 20,000 square miles, or nearly two-thirds of the State of South Carolina. Several wells have been drilled in the State through the Tertiary and Cretaceous sediments, but no indications of petroleum or natural gas have been discovered.

55(792)

BULL. 863. GEOLOGY OF THE SALT VALLEY ANTICLINE AND ADJACENT AREAS, GRAND COUNTY, UTAH. C. H. Dane. Pp. v, 184. 1936, Superintendent of Documents, Washington, D.C. $1.0.

This report describes an area of about 800 square miles of semi-arid, rugged country in Grand County, Utah, adjacent to the Utah–Colorado line. So far, drilling for oil and gas has failed to obtain commercial production, but the showings encountered demonstrate that oil and gas are not completely absent. Until the area has been exhaustively tested there still remains some possibility of commercial production.

553.64(786)

BULL. 847-D. PHOSPHATE ROCK NEAR MAXVILLE, PHILIPSBURG, AND AVON, MONTANA. J. T. Pardee. Pp. ii, 14. 1936, Superintendent of Documents, Washington, D.C. 20 cents.

553.94(792)

BULL. 852. THE BOOK CLIFFS COAL-FIELD IN EMERY AND GRAND COUNTIES, UTAH. D. Jerome Fisher. Pp. iv, 104. 1936, Superintendent of Documents, Washington, D.C. 75 cents.

The area described lies between Sunnyside, Utah, and the Utah–Colorado line. Oil and gas prospecting has been carried on at two places, and very small amounts of oil were obtained near Crescent. Gas has been obtained in the Cisco district and two wells on the Harley Dome are reported to have had heavy flows of non-flammable helium-bearing gas at about 600 feet.

ABSTRACTS.

	PAGE
Geology	474 A
Geophysics	481 A
Drilling	482 A
Production	488 A
Transport and Storage	492 A
Chemistry of Petroleum ...	495 A
Analysis and Testing	495 A
Gas	499 A
Crude Oil	500 A
Refining and Refinery Plant ...	502 A
Corrosion	503 A
Cracking	504 A
Hydrogenation	505 A
Motor Fuels	505 A
Lubricants and Lubrication ...	510 A
Fuel Oil	512 A
Asphalt and Bitumen	513 A
Special Products	514 A
Coal and Shale	516 A
Engines	517 A
Economics and Statistics ...	517 A
Reviews and Books Received ...	521 A

AUTHOR INDEX.

The numbers refer to the Abstract Number.

Albright, J. C., 1319, 1383
Arutyunov, M. S., 1368
Assheton, E., 1370

Baldakova, R., 1382
Ballas, A., 1405
Bart, E., 1382
Bataafsche Petroleum Mij., 1394, 1405
Bell, O., 1391
Bennazar, J., 1333
Bignell, L. G. E., 1369, 1902, 1306, 1307, 1308
Black, L. C., 1399
Bles, L. W., 1377
Bottomley, H., 1345
Bridgeman, O. C., 1381
Brown, G. G., 1410
Bruce, R. N. B. D., 1357
Bruns, J. H., 1344, 1352
Burwell, A. W., 1347
Byran, R. W., 1304

Camelford, J. A., 1347
Candea, C., 1356
Carnahan, F. L., 1343
Carpmael, A., 1405
Cats, J. A., 1413
Childs, W. L., 1299
Christensen, L. M., 1377
Church, W. L., 1375
Claffey, L. W., 1353
Clough, K. H., 1297
Coberly, C. J., 1299
Compagnie de Bethune, 1374
Conine, R. C., 1313
Creek, W., 1299
Crowell, E. V., 1299

Dale Condit, D., 1289
Davenport, J. E., 1346
Davis, A. F., 1337
Deckendorff, R. L., 1340
Dreyer, W. C., 1334
Drysdale, J. K., 1394

Eddy, G. H., 1373
Edeleanu Ges., 1394
Egloff, G., 1371, 1378
Ellis, E. W., 1343
Ellis, L. A., 1326
Evans, R. N., 1346

Fanlconer, W. B. M., 1344
Field, E., 1351
Finaton, C., 1367
Flury, W. J., 1299
Fortine, D. H., 1363
Fry, E. M., 1348
Fuesting, R., 1373

Ganitzki, I., 1414, 1415
Gas Light & Coke Co., 1357
Gavrun, E., 1367
Gemant, A., 1390
Gervart, Y., 1382
Glendinning, E. V., 1399
Griffen, C. W., 1349
Griffith, R. H., 1357
Grosdovskaya, R. I., 1294

Haferer, D. W., 1299
Hanlon, H., 1399
Harrington, G. G., 1299
Harry, R. G., 1402
Haymann, D. F., 1336
Herzog, E. J., 1288
Hollings, H., 1357
Holm, M. M., 1376
Howard, J. H., 1299
Huntington, R. L., 1355

Ickes, E. L., 1411
I.G. Farbenindustrie A.-G., 1405
International Hydrogenation Patents Co., 1374
Ireland, H. A., 1275

Johnson, J. Y., 1374, 1405

Kallam, F. L., 1365
Karabain, W. A., 1384
Kashima, S., 1379
Klonnek, F., 1374
Kobuli'skaya, M. Y., 1335
Kornfeld, J. A., 1334
Krefft, O. T., 1403
Kubie, Y., 1393
Kühn, J., 1356
Kyropoulos, S., 1389

Lane, W. C., 1399
Lect, G., 1394
Lichis, L. C., 1375
Liddicoat, P., 1399
Livshits, S. E., 1335
Logan, K. H., 1328
Lorraine, D. G., 1399

MacClatchie, J. W., 1299
McMillan, W. A., 1342
Maksimovich, G., 1339
Maple, A. F., 1364
Martens, J. H. C., 1362
Mayes, H. B., 1332
Meyer, G., 1399
Meshebovskaya, E., 1385
Miller, C. C., 1341
Moldavskii, B. O., 1335
Morrell, J. C., 1378

Nederbragt, G. W., 1388
Negreev, V. F., 1368
Nelson, E. F., 1371
Nelson, W. L., 1364
Newcombe, R. B., 1360
Niedert, J. B., 1338

Oppenheim, V., 1361
Otis, H. O., 1299, 1309
Otsuka, H., 1373

Parker, R. W., 1335
Payne, E. H., 1341
Pearl, W. A., 1410
Penick, A. J., 1299
Penick, K. T., 1299
Pennington, J. V., 1299
Pinkley, G. R., 1370
Piotrowsky, W. de, 1401
Pipik, O., 1385
Pienti, A. A., 1338
Ponyatkov, —, 1360
Post, E. S., 1271, 1280
Potts, H. E., 1374
Precoul, M., 1406
Prescott, H. R., 1277
Pratton, C. F., 1334

Raggatt, H. G., 1289
Rall, H. T., 1357
Read, A. L., 1387
Reed, P., 1317, 1322
Reeves, J. R., 1263
Rescoria, A. R., 1343
Rogers, J., 1312
Ross, J. S., 1290
Rudd, E. A., 1289
Ruggles, J. P., 1368
Ryder, H. W., 1316

Saaf, M. von, 1349
Sadakiyo, G., 1361
Sager, F., 1384
Sanders, A. P., 1409
Sanders, T. P., 1286, 1292, 1303, 1310, 1315
Sauter, V., 1374
Sawdon, W. A., 1378
Schmalfeldt, H., 1386
Schnidman, 1396
Sclater, K. C., 1281
Separator-Nobel Akt., 1394
Shaw, S. F., 1318
Shrimpton, D. J., 1284
Simmons, A. C., 1314
Siracusa, S., 1399
Sionneger, J. C., 1311
Smith, A. K., 1394
Smith, E. R., 1299
Smith, H. M., 1337
Smith, J. W., 1400
Snelgr, D., 1320, 1331
Spain, E. L., 1280
Spicker, E. M., 1276
Squires, L., 1340
Standard Oil Development Co., 1394
Starr, L. T., 1299
Statham, L., 1377
Sterrett, E., 1323
Stockman, L. P., 1353
Stormont, D. H., 1403
Strong, J. R., 1350
Studien und Verwertungsgese. mit Beschränkter Hartung, 1357
Sullivan, W. A., 1399

Taylor, C. C., 1299
Taylor, F. B., 1321
Taylor, W. G., 1287
Terry, J. B., 1351
Texaco Development Corporation, 1394
Thayer, S., 1329
Tijmstra, S., 1394
Towers, L. H., 1301
Trask, P. D., 1365
Trauta, O. R., 1338
Treacott, L. C., 1398
Triggs, W. W., 1405
Trusty, A. W., 1395
Tucker, M., 1282, 1298

Vetters, H., 1366
Villers, A., 1299
Voronov, A., 1393

Weber, G., 1393
Williams, M., 1279, 1295, 1295, 1296, 1330, 1362
Wilson, O. W., 1360
Winkler, J., 1401
Wintershall A.-G., 1386
Wirth, C., 1350
Wright, J. C., 1299

Yaichnikova, E. A., 1294
Yeaw, J. S., 1396
Yowell, O. P., 1299

Ziegenhain, W. T., 1285, 1291
Zinner, K., 1397
Zinrya, B. J., 1375

Geology.

55 (941)

1259. Geology of North-West Basin, Western Australia. D. Dale Condit, H. G. Raggatt, and E. A. Rudd. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 1028–1070.—The north-west basin is a coastal area, 400 miles long by 100 miles wide, and composed of Permo-Carboniferous, Mesozoic, and Tertiary strata which have a regional westward dip and rest on pre-Cambrian basement rocks.

The contact of the Permo-Carboniferous and the Pre-Cambrian is locally faulted, but mainly one of normal deposition on an eroded basement. Where covered by younger rocks, these are generally Cretaceous in age, and the data available suggest that the Permo-Carboniferous was folded into broad structures which were denuded to an approximately uniform surface before the Cretaceous was deposited. The Permo-Carboniferous is divided into two series, the lower consisting largely of fluvio-glacial beds, and called the Lyons series, and the upper consisting of shales, sandstones and limestones, and called the Gascoyne series. The Lyons series is 2000–2450 ft. thick, and consists of sandstone, boulder beds, conglomerate and shale, most of which strata were probably derived from neighbouring areas being subjected to glaciation. The Gascoyne series, some 4000–5000 ft. thick, is divided into five formations: the Callytharra limestone, the Wooramel sandstone, the Byro formation, the Kennedy sandstone, and the Wandagee formation. There is no marked unconformity between the Callytharra and the underlying Lyons series. It consists of flaggy limestones and shale beds, and shows progressive thickening from 85 ft. to more than 450 ft. towards the N.W. It is overlain conformably by the 800-ft.-thick Wooramel sandstone, and the junction between this and the Byro formation is marked by carbonaceous beds. The Byro is about 600 ft. thick at the type locality, but shows some thickening northwards. It is characterized by a number of richly fossiliferous zones separated by almost barren strata, and is followed by the Kennedy sandstone, one of the most important aquifers in the basin. Above the Kennedy there is considerable thickness of shaly strata, the Wandagee formation, which is little seen in outcrop, but may be traced by well logs. This forms the top of the Permo-Carboniferous.

It has been proved by recent work that the rocks formerly placed in the Jurassic are really Cretaceous in age, and that they cover a much wider area than had been supposed. They are divided into a lower series of radiolarian cherts and white and variegated silts—the Winning series—and an upper series of limestones, chalks, shales and glauconitic sand—the Cardabia series. Such Tertiary beds as are present are mostly limestones, and overlap occurs. The lowest horizons are Mid.-Upper Eocene, and their relationship to higher Tertiaries is unknown. Post-Tertiary deposits, Pleistocene and Recent, are extensive.

Structurally the area forms the eastern limb of a synclinorial basin. Folding is more or less general over the Permo-Carboniferous outcrop. A disturbed zone extends from Arthur river to Lyndon, a distance of 135 miles. It commences as a zone of folding which develops into faulting. There is another disturbed zone in the Middalya area. A number of folds, trending somewhat E. of N., have also been observed in the area of the Cretaceous–Tertiary outcrop.

Suitable source-beds for petroleum are to be found not only in the Permo-Carboniferous, but also in the Cretaceous and Tertiary. With regard to cover rocks, there are large thicknesses of suitable rock in the Gascoyne series, and possibly also in the Cretaceous. The tendency to lensing in the Byro and Wandagee formations is also favourable for reservoir conditions. Shows of oil and gas are unknown except for a few gas-shows in water wells. These wells, however, are in unsuitable locations for the testing of petroleum prospects. The general conclusion is that an open mind on oil possibilities must be kept until further work has been carried out. S. E. C.

551.73 (768)

1260. Upper Palæozoic Development of Nashville Dome, Tennessee. C. W. Wilson and E. L. Spain. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 1071–1085.—The Nashville dome, occupying the whole of central Tennessee, is a large anticlinal structure on the S. end of the Cincinnati arch. Minor folds which are irregular in shape and show no parallelism of axes are developed on its gentle dipping flanks. The origin of these

folds is suggested as being due to differential vertical uplift such as would accompany the irregular vertical bulging of the Nashville dome by stresses transmitted plastically in the deeper portions of the crust. The stresses which caused the development of the dome may have originated from the Appalachian geoanticline separated from the dome by the corresponding geosyncline. Periods of rise and fall in the dome are shown to synchronize with similar periods in the geoanticline. A summary is given of the Upper Palæozoic stratigraphy of the region, and the history of the dome is briefly reviewed.
S. E. C.

551.734 (81) (89)

1261. Geology of Devonian Areas of Paranã Basin in Brazil, Uruguay, and Paraguay. V. Oppenheim. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 1208–1236.—The Devonian area in the state of Paranã forms a narrow, curved strip between Serrinha and São Paulo, a distance of over 300 km. Its greatest width is 40 km. The western edge and the N.E. and S.E. extremities dip under the Permian glacial deposits, whilst the eastern edge forms an abrupt sandstone escarpment. The Devonian rocks fall into two distinct lithological groups: a lower sandstone series—the Furnas sandstone—and an upper shale series—the Ponta Grossa formation—which includes the intercalated Tibagy sandstone. The Furnas sandstone forms extensive outcrops of light, uniform, coarse sandstone which rests discordantly on the ancient phyllites and mica schists. Its characteristics suggest deposition in estuaries, and it has a maximum thickness of 50–300 m. The Ponta Grossa shale is uniform throughout the area, and is a grey, micaceous shale of medium hardness. In places the upper parts are carbonaceous and possibly bituminous. Recent field observations point to the fine-grained Tibagy sandstone being merely a local facies of the Ponta Grossa shale, and not forming a separate upper horizon. The thickness of the formation is of the order of 150 m. The Devonian rocks as a whole are subjected to the same intrusion of basalt and diabase intrusives as the Gondwana system.

The Devonian rocks N., S. and W. of the Paranã basin are also described. There are two narrow strips along the Lower Amazon valley which yield faunas ranging from early to mid Devonian in age. The early Devonian faunas are distinctly northern in type. The Devonian sediments of Matto Grosso are intermediate in character between those of the Lower Amazon and of Paranã and, whilst their fauna is typically southern, some species of a northern type are found. There is as yet insufficient evidence to permit of a discussion of the Devonian in the state of Goyas. In Uruguay the Carmen sandstone is identical with the Furnas sandstone of Paranã. The fossiliferous shales are also lithologically the same as the Ponta Grossa shales, but their fauna permits of correlation with the Lower Amazon sediments. There is not only a palæontological difference, but also a petrological between the Devonian of Paranã and of Paraguay. The Devonian in Paraguay consists of light-coloured shales and micaceous sandstone, followed by red, medium-grained sandstones, and contains a fauna related to that of the Devonian of the Amazon.

The general characteristics of the Devonian of Paranã and the surrounding districts suggest that it was deposited in great lagoons of salt-water, periodically connected, but usually separate. Borings in Uruguay show that to the N. and W. of the Devonian the Gondwana rests directly on the basement complex, thus tending to confirm the presence of barriers between the Devonian seas.
S. E. C.

552.2 : 551.734 (754)

1262. Petrography of Oriskany and Corniferous Sands in W. Virginia. J. H. C. Martens. *Oil & Gas J.*, 1.10.36, **35** (20), 21, 23.—In this area the Corniferous varies from 53 to approximately 200 ft., and is mainly composed of chert with a subordinate amount of calcite. The upper few feet sometimes contains a thin bed of cherty limestone, and this is occasionally capped by a small thickness of brown silty shale which probably forms a thin layer between the Corniferous and the overlying Marcellus Shale. The lower section of the Corniferous is characterized by a small amount of fine sand embedded in the chert. The principal minerals are chalcedony, quartz and calcite. Other minerals present are dolomite, glauconite, barite, pyrite and sphalerite. The total heavy mineral crop is very small, and consists of pyrite, leucoxene, zircon, tourmaline and rutile, this being their order of abundance.

The Oriskany varies from 8 to about 115 feet in thickness, and is a light-grey to white sandstone, often, though not consistently, highly calcareous. The lower portion is usually finer grained than the upper. It is composed mainly of quartz and calcite, other minerals being comparatively rare. Glauconite and pyrite do occur in some abundance, but the former is concentrated near the top of the formation. After removal of the pyrite the total heavy mineral crop forms only 0·01%, and consists of zircon, leucoxene, tourmaline and rutile. Sphalerite and barite are also present.

Owing to the absence of mica and felspar, the fairly high degree of rounding, and the small amount of heavy minerals, it is considered that the Oriskany was derived from older sandstones, and not directly from igneous or metamorphic rocks. J. A. G.

553.981 (748)

1263. Hebron Gas Field, Potter County, Pennsylvania. J. R. Reeves. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 1019–1027.—The Hebron gas field is situated some 35 miles S.E. of Bradford. Gas has been produced from shallow sands in the middle and lower parts of the Chemung group for more than 30 years, but in December 1931 production was also obtained from the Oriskany sandstone (Devonian) at a depth of 4924 ft. The structure is part of the Hebron anticline which may be traced for over 75 miles, and the closure forming the gas field is 1½ miles wide by 12 miles long. There is some evidence which points to faulting near the N.E. end, where there is a difference of 300 ft. in the depth of the Oriskany between adjacent wells. If this faulting be accepted, it is probable that it decreases and displacement dies out 1000 ft. above the Oriskany, and that it parallels and extends the full length of the closure. There is also a suggestion of a subsidiary closure S.E. of this critical belt.

The producing area of the Oriskany is 3800 acres, and the total production to the beginning of 1936 was 34 billion cu. ft. The productive area is well defined on the N., S. and E. of the field, but on the W. the Oriskany sandstone is not present and the limit has not been definitely found. The maximum thickness does not exceed 35 ft., the pay sands ranging from 4 to 12 ft. and occurring below a hard, non-porous section 1–4 ft. thick. Porosity in the productive zones varies from 9 to 14%. The pressure decline, a total of 500 lbs./sq. inch from initial pressures of 2150 lbs./sq. inch, has been remarkably uniform in all wells. S. E. C.

553.982

1264. Discovering Oil from 20,000 Feet. A. F. Maple. *World Petr.*, 1936, **7**, 181–184.—Petroleum geologists are making use of every new scientific development that will assist them in the field of exploration. Aerial photography is accepted to-day as the best means by which the surface can be mapped preparatory to detailed operations on the ground. In this article the process of mapping from the air is described, particular reference being made to the use of the stereoscope and the stereoplanigraph. The latter instrument is based on the principle of the stereoscope, and it is used to develop contour maps from aerial-photo plates. W. W.

553.982

1265. Summary of Recent Foreign Literature on the Problem of Petroleum Generation. P. D. Trask. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 1237–1249.—Short summaries are given of the more important papers dealing with the origin of petroleum which are not easily obtained by most American geologists. A total of 41 papers is listed. S. E. C.

553.982 (436)

1266. Domestic Crude for Austrian Defence? H. Vetters. *World Petr.*, 1936, **7**, 435–438, 454, 456.—Various geologists were interested in the possibilities of finding commercial quantities of oil in Austria before the War, but assurance that such oil does exist was acquired only quite recently. Six years ago, in drilling a well, a gas blow-out led to a production of 500 tons. Commercial production began only in November 1932, making 120 tons in 1932 and progressing to 6,616 tons in 1935. Natural gas has been known in Austria for nearly a century, but the present major source was first discovered in 1891, at Wels. Since then gas has been produced from more than

150 water wells around Wels at varying depths down to 350 meters. Total production to date is about 90 million cubic meters. Traces of oil were found in the Schlier district, and an oil suitable for manufacture of cylinder oils was struck in a sand above the crystalline basement rocks. The quantity was estimated at 60,000 tons. The oil was not formed in the sands over the crystalline, but *emigrated* from the adjoining Schlier beds. The main interest to-day, however, is in the Alpine Tertiaries of the Vienna basin, so far as oil and gas production is concerned, where the shallow Sarmatian are productive. Oil was first discovered at Eigbell (to-day Gbely), where there are now more than 400 wells producing daily about 40 tons of oil. Up to the end of 1934 more than 19,000 cars (about 199,000 tons) had been produced from two fields at Gbely. Details are given of drilling and production at Göding (Hodonin), Hohenau and Rabensburg, Maria Lanzendorf, Oberlaa, Enzersdorf, on the Fischa, Podersdorf in Burgenland, Wollmanusberg, Wolkersdorf, Steinberg near Zietersdorf, Windisch-Baumgarten and Community Gösting. Geological work definitely shows that in the Vienna basin, as in Moravia and Slovacia, dome structure plays an important part in the tectonics of the region. Very promising results were obtained from a well N.W. of the Community of Neuseidl. After going through the Sarmatian (967–1174 metres) without finding oil, the well obtained an oil considerably lighter than any as yet produced in the district. Where the oil has been found below the Sarmatian it occurs in a slaty sandstone, apparently from crevasses in it. The oils from the Sarmatian beds differ from those found in the slaty formation, but the Sarmatian when oil-bearing adjoins the slate formation, and it is possible that the Sarmatian oil has migrated from fissures in the slaty formations. The Sarmatian oil from 3 Gösting wells at depths of 785 m., 926 m. and 1107 m. showed sp. grs. of 0·939, 0·938 and 0·946, being thick oils with an asphalt base. The oil obtained from wells in Windisch-Baumgarten and from Gösting No. 1 deepened from 785 m. to 796 m. was a little better, and that from the Neuseidl slate formation shows more desirable properties. B. F. N. M.

553.982 (444.7)

1987. Search for Oil in the Southern Jura. C. Finaton. *Rev. Petr.*, 3.10.36, (703), 1479–1482.—Exploration for oil in France by the Government has extended to the region S.E. of Jura. To follow the object of the exploration the geological structure of the Jura Mountain Chain must be broadly reviewed, and the indications of hydrocarbons, known for a long time, must be recorded. Up to Middle Cretaceous times the position occupied by the Jura Mountains was a vast geosynclinal in which all the series of the secondary terrains were deposited (Palæozoic terrains were only sparsely observed, their continuity under the Mountains not being as yet established). During the Middle Cretaceous period, the Jurassic region, as yet unfolded, appears to have completely emerged. The Jurassic was not folded into its present relief until the end of the middle Miocene times. A very interesting formation is found in the Tertiaries, the Molasse, which is a calcareous or soft argillaceous sandstone of lacrustine or littoral origin where it is found belonging to the Upper Oligocene, and in the Lower Miocene is sometimes of fresh water, sometimes of marine or brackish water origin. The Lower Molasse (Upper Oligocene) occurs in the old Gulf which formed Alsace, and does not go beyond the north of the Jura. The Lower Miocene, or Upper, Molasse has been deposited throughout the neighbourhood of Geneva, and extends as far as the Alps to the south. The Molasse in its typical constitution appears to be an ideal formation to contain hydrocarbons, and important indications are found in all the region in which it is known. The clearest and most northern instance is in Switzerland—the well-known deposit of Val de Travers between Lake Neufchatel and the French frontier. In a synclinal fold of Jurassic limestones, Gault of the Cretaceous deeply eroded is covered by sheets of Molasse. The Urgonian and Aptian limestones here are asphaltic, and one layer, one third of a metre thick, gave a bitumen content of 10–12%, which, on distillation, produced water, oil and gas; the oil on redistillation supplied motor spirits, oils and tars. These Cretaceous bituminous rocks are almost continuous going south, and the Molasse is always close to these beds, and is found finally to be impregnated with a dark brown paraffinous oil. Near the Swiss village of La Plaine, in wells, the marine Molasse showed important oil exudations and even some gas emanations. In the same region, on the French side, a well drilled in 1918–1919 had three impregnated levels in sandstones, but no gas emanations. Near five Swiss villages in the Geneva Plain, and on the French side at another five villages, important im-

pregnations and exudations of asphalt and bitumens have been noticed in the Molasse and at the transgression contact of the Molasse on the Cretaceous, and there are also traces here and there of old workings for asphalt in this region. A sketch map of the country round Geneva, showing the boundaries of the secondary groups and outcrops and the anticlinal folds, is followed by a detailed log of a well drilled at Frangy, S.S.W. of Geneva. It shows alternations of sandstones, sands and marls which appear suitable as reservoir rocks for the conservation of hydrocarbons, but, these alternations being similar to extremely flattened lenticular beds, it seemed doubtful that, if only some beds can act as reservoir rocks, the series as a whole will be found impregnated. The Chilly well produced a core of sandstone impregnated with oil which stained the fingers, a little of which came up with the drilling water, but all trials to exhaust the well obtained nothing but oozings. The author ends by reaching the conclusions that the Franco-Swiss Molasse has indubitable signs of hydrocarbon content, and that drilling both in Switzerland (La Plaine) and in France at Challex and Frangy have revealed clearly impregnated beds, which are, however, far from yielding an industrial supply. He suggests that, with a view to obtain such a supply, it would be better to go a little farther from the outcrops laid bare by erosion which could engender water levels to flood the sandstones. The immediate neighbourhood of the Jurassic folds which put the fissured Urgonian in contact with the Molasse seems much from favourable. The author's opinion is that a well placed boldly in the plain close to a gentle anticlinal fold, such as have been noticed here and there in the ravines cut so deeply by the water courses, would perhaps have better chances of being productive. B. F. N. M.

553.982 (748)

1268. Oil in Oriskany. J. P. Ruggles. *Oil Weekly*, 21.9.36, **83** (2), 43–46.—Due to the striking of gas accompanied by distillate in the first foot of the Oriskany sand, Western Pennsylvania has revived. Up to the time of this strike the Oriskany sand was universally believed to be no better than a pure and simple gas-sand. On testing the new discovery by distillation, the naphtha content was found to be 60%, with a gravity of 55·6. The well sprayed fluid slightly. After shooting with a 20-quart charge, the gas increased from 300,000 to 2,000,000 cubic ft. and fluidity also increased. It is estimated by geologists that there is a large area in which Oriskany sands may be productive. It is expected that an oil pool will be struck further down the dip from the new discovery. Some years ago the senior geologist of the Pennsylvania Geologic Department stated that surveys indicated that there were three independent lakes of oil within an area of 12,000 sq. miles, of which the best section seems to be the northern plateau. B. F. N. M.

553.982 (76)

1269. Northern Rim of Coastal Plain Contains Untapped Reserves. L. G. E. Bignell. *Oil & Gas J.*, 3.9.36, **35** (16), 11–12.—Recent tests in this region have proved that the Glen Rose and Trinity formations exist over a large area. In pre-Cretaceous times sediments from a land area to the south were deposited in the Ouachita geosyncline. Folding and thrusting of these sediments resulted in the formation of the Ouachita mountains with a basin to the south of them in which Permian sediments were deposited. The continuation of the Ouachita mountains under the Coastal Plain has been traced from Oklahoma to Central Texas, and they are also believed to extend in a S.E. direction through S. Arkansas, N.E. Louisiana and Mississippi into Alabama.

By Mesozoic times denudation had reduced this region to a peneplain which, due to downwarping, was invaded by the early Cretaceous sea. The youngest sediments are a series of impure limestones and shales with fine-grained sands which reach a thickness of more than 1500 ft. in Arkansas. The Neocomian sea retreated, and about 2000 ft. of red clays and sands accumulated. The area was again invaded by the sea, and the Glen Rose was deposited. The latter is divided into Upper and Lower by a bed of anhydrite and limestone. The Lower Glen Rose is mainly impure limestones and shales, and decreases in thickness towards N. and E. Arkansas. Following the deposition of the anhydrite zone, marine conditions continued for a while, but were followed by regression and the deposition of red clays and sands, which interfinger basin-wards with marine limestones and shales. This movement resulted in the forma-

tion of the Paluxy Sand which forms the top of the Trinity Group (Comanche Series). It is in the Trinity that oil has been found in this region.

In post-Cretaceous times further movements took place which resulted in N. Louisiana and S. Arkansas being uplifted at the same time as embayments on both sides were depressed, the movement terminating in Tertiary times.

The conditions dominant during Cretaceous times are considered to have been favourable to the formation of source and reservoir rocks, and further important discoveries are predicted in this region. J. A. G.

553.982(764)

1270. Outstanding Features of South Texas Geology. G. R. Pinkley. *Oil Weekly*, 28.9.36, **83** (3), 51–60.—In South Texas 800,000,000 brls. of recoverable oil have been uncovered in formations ranging from Ordovician in the Hill Country to latest Tertiary on the Gulf Coast. The sediments increase in thickness towards the coast. The northernmost fields consist of a number of small pools where production is obtained from porous parts of buried serpentine plugs. These plugs are in the lower Taylor and upper Austin formations, and range from a few hundred feet to two miles in width. Thrall is the oldest and largest field of this type, covering 475 acres, and having given 2,169,225 brls. of oil. These plugs are readily found by magnetic surveys, and some are expressed in the surface structure due to differential compaction and possibly uplift.

The Luling, Salt Flats and Darst Creek pools are major structures with 200–500 ft. of closure against major strike faults of 350–500 ft. throw. Such features seem essential for Edwards lime production. In spite of deep tests at Luling and Darst Creek, it cannot yet be said that this area is unfavourable for production from the underlying Glen Rose and Trinity formations.

To the south-west in Bexar county are several fields which have yielded some 13,000,000 brls. of oil from the Taylor and Navarro, and the Austin shows some heavy oil over most of the area. In the south of Bexar and the adjoining counties are several large structures, and wells to the Glenrose and the Trinity have had showings of oil.

In the Pearsall area of Frio county commercial production has been obtained from the Navarro, Austin and Buda formations, and interesting showings occur in the Georgetown, Edwards and Glenrose. The structure is apparently a large fold parallel to the Balcones folding zone, with production in the blanket sands and crevices on the crest of the structure.

West of San Antonio and north of Frio county some wildcatting has been done, but commercial oil has not yet been found. There are thick Cretaceous limes at the surface which are mainly freshwater bearing. Beneath are Pennsylvanian shales and sands, and in some places Ordovician limestones.

The strip of land running through eastern Zapata, eastern Webb, western Jim Hogg, northern Starr and western Duval counties has given mixed-base oil for 15 years the Jackson and Yegua formations at depths of 400–3500 ft. This area has about 40 fields covering 30,000 acres. It seems that there is a number of regionally high areas where sand lenses are saturated with oil. These lenses may cover several thousand acres or merge into shale in a few hundred feet. Generally the sands represent old shore-lines.

In northern Bee county and the adjacent area most of the oil is from the Pettus sand of Cockfield age. This sand is a blanket formation with production entirely due to structure. Some oil has been found in the Whitsett and Hockleyensis sands of younger Jackson age, probably in sand lenses. Deeper Yegua and Cook Mountain production seems possible in this region.

Samfordyce in the Rio Grande valley appears to give oil from sand lenses at depths of 1200–1400 ft. and 2700–2900 ft. on the western flank of a large fold.

The Corpus Christi area is a high zone between two salt-dome areas, and yields oil from the Miocene and Oligocene. Large structures and the presence of sands seem essential for good production. In the south-western salt basin the domes of Palangana, Piedras Pintas, Alta Verde and Alta Mesa have produced oil in commercial quantities. At least another dozen domes are known. Most of the domes are of the piercement type. G. D. H.

553.982(764)

1271. South Texas Reserves are Increasing Rapidly. E. S. Post. *Oil Weekly*, 28.9.36, **83** (3), 41–48.—It is estimated that 836,437,000 brls. of producible oil have been discovered in South Texas, and that only 37% of this has been recovered to date. New producing areas are being opened up almost continuously. Details are given of the age, extent, reserves, recovery, etc. in the various fields, there being 176 oil and gas fields in all.

At present operations centre round Tertiary production. The Miocene–Oligocene production is in the immediate coastal trend from Wharton county on the east through Corpus Christi to the Mexican border in the Rio Grande valley. The Jackson trend follows the same line about 60–80 miles farther inland, and gives Whitsett, Hockleyensis, Cockfield, Yegua, Cook Mountain and Mount Selman production. The Corpus Christi trend has 34 fields covering 20,565 acres. Most of the production is from depths of 4000–6000 ft. The wells are widely spaced, and the presence of plenty of gas reduces lifting costs.

On the Jackson trend drilling is mainly to depths of 2000–4000 ft. The Mirando area gives prolific fields in the higher zones of the Jackson at about 2200–2800 ft. The sands are known locally as Chernoskey, Government Wells Loma Novia, and Mirando. The Pettus area production is at 3600–4300 ft. in the Cockfield and upper Yegua. Its oil is of high gravity, whilst that of the Mirando area is of low gravity. The Jackson trend has 57 fields covering 37,881 acres.

The Balcones fault zone of South Texas is made up of shallow Navarro–Taylor sand and shales, Serpentine, and the Austin Chalk–Edwards limestone group. The Edwards limestone is the most prolific horizon in South Texas, but its producing area is limited to Caldwell and Guadalupe counties. Serpentine production is mainly in Williamson, Travis, Bastrop and northern Caldwell counties. Its depth is generally about 2000 ft. The ultimate recovery is estimated at 6132 brls./acre. The Navarro and Taylor sands and shales, at 500–1000 ft. in the main, give a poor recovery, but drilling is cheap. G. D. H.

553.982(766)

1272. Use of Insoluble Residues for Correlation in Oklahoma. H. A. Ireland. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 1086–1121.—The term "insoluble residue" here refers to all material insoluble in cold commercial hydrochloric acid which has been diluted with an equal volume of water. More than 6000 samples of Ordovician to Devonian age from the Ozark area, N.E. Oklahoma, and from central and S. Oklahoma were examined. It was found to be possible to recognize a number of zones when all the characteristics of the residues were taken into consideration. The use of the residues is confined to calcareous strata. Non-calcareous strata provide information only when their relationship to limestones is known. Long-distance correlation in Oklahoma by this means is satisfactory only in the case of the Hunton and Fernvale formations, which have a more or less constant residue. In the case of the Simpson, although it can be divided into zones, the residues are variable and difficult to recognize unless lateral variation is carefully noted. The characteristics of the constituents of the residues are described, and full descriptions are given of the residues obtained from the different formations. S. E. C.

553.982(774)

1273. Geology of Crystal Field Shows Importance of Folding in Oil Accumulation. G. E. Eddy. *Oil & Gas J.*, 3.9.36, **35** (16), 32, 35, 38.—The Crystal Pool lies on one of the principal N.W.–S.E. structural trends in the Michigan Basin, and accumulation has taken place on a flat-topped anticline which has a steep dip to the N.E. and a more gentle slope to the S.W. Wells drilled for a distance of 6 miles down this latter flank show a dip of only a few feet per mile.

The general stratigraphy shows the Monroe Limestone at a depth of about 5000 ft., followed by the Dundee Limestone and Dolomite, the latter being unconformably overlain by the Bell Shale. The Traverse Group follows, and consists mainly of shales and limestones. Above this are the Antrim Shales and the Coldwater Shales. The Lower and Upper Marshall shales and sandstones come next, and are capped by the Michigan Series of shales, gypsum and limestone.

Production conforms roughly to the surface of the Dundee formation, and it would seem that the structure is due either to slumping of the strata over the irregular topography of the Dundee or to normal folding along zones of weakness. Possibly it is a combination of both. The porosity of the Dundee is probably due to solution of the limestone before and during the deposition of the overlying Bell Series. Production is patchy, and several dry holes have been drilled as offsets to a well giving commercial production. Some wells gave an initial yield of 8000 brls. per day, and the main source of energy is probably water-drive, there being very little gas pressure in the field.

J. A. G.

553.982(825.1)

1274. Drilling of Pampa Amarillo. Anon. *Boll. Inform. Petroleras* (B.A.), July 1936, **13** (143), 49–51.—On September 25th, 1935, Vaciementos Petroliferos Fiscales began the drilling of the Well Pampa Amarillo No. 1 in the Department of San Rafael, Mendoza Province at about 200 km. S.W. of the city of San Rafael. The drilling proceeded normally without incident until early July, when, at a depth of 1023 m., a coarse-grained sandstone was penetrated with shows of oil continuing to 1026 m. A test for production was made, which gave 400 litres of oil, the well being recorded dry. Having resumed drilling, at a depth of 1027 m. another sand of similar characteristics was struck, raising the level of the oil to 100 m. above the bottom of the well. A test of the new sand was made which gave 6500 litres of oil, the well again being recorded dry. It was decided to continue the well deeper, as it was realized that the beds gone through were lacking in commercial value, but, in the circumstances, that the oil-shows were encountered at less depths than the geologists expected to find the oil formation, the decision to drill deeper was justified. With this object the well is being cemented in the 10¾-in. casing at a depth of 927 m. B. F. N. M.

551.7 : 608.3

1275. Patent on Geological Apparatus. Apparatus for taking Samples from Wells. U.S.P. 2,053,698. W. L. Church, 8.9.36. Objects of this invention are to provide a device of a character specially designed for the purposes of taking samples of the geological formations of the walls of a well bore; to provide means of letting down into and withdrawing the device from a well bore by a cable or other flexible line; the device will be in a collapsed or inactive position while lowered, but under the control of the operator who can actuate it into active position to collect samples of the wall structure, and thereupon the device can be again collapsed for withdrawal from the bore hole. Six claims. B. F. N. M.

Geophysics.

550.837

1276. Radio Transmission and Geology. E. M. Spieker. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 1123–1124.—The author summarizes a Report by R. C. Higgy and E. D. Shipley on "Radio Transmission Survey of Ohio." The phenomenon with definite geological implications occurred once before, and in 1934 E. Cloos published the results of observations in which he found that broadcast reception by automobile radio fell off notably as his car crossed faults and steeply dipping contacts between different kinds of rocks. The report here reviewed was made after measurements of conductivity, with apparatus designed for the purpose and used under controlled conditions, had shown that surface geology has effects on radio transmission more extensive than that shown by Cloos, and confirming his prediction that radio transmission would embrace a useful geophysical principle. The radio transmission map accompanying the report separates the State into four zones graded as to effectiveness of transmission. It thus becomes a lithological map of the State. The N.W. part of Ohio is one zone, outlining roughly an area underlain by Ordovician, Silurian and Devonian limestones. This zone furnished the best transmission. A belt dominantly of Devonian and Mississippian shale was the next best zone. The Pennsylvanian–Peruvian coal measures, lithologically very varied and containing much sandstone, was the next zone, and the last and poorest zone probably corresponds with a large channel or group of channels buried under Pleistocene materials. From these facts it appears that radio transmission is affected by the texture of the surface and for

mmediate sub-surface rocks. Tight solid rock affords the best conditions and loose open textured the worst. B. F. N. M.

1277. Patents on Geophysics. 550.834 : 608.3

Method and Apparatus for making Geophysical Exploration. U.S.P. 2,053,841. H. R. Prescott. 8.9.36. One object of this invention is to provide a means and method in which both high and low pass filters are automatically adjusted to the end that seismic waves from geological beds at different depths are received at maximum clarity. Another object is to provide a means of making seismic geological explorations, which will permit the direct wave to be admitted while automatically filtering the reflected seismic waves from shallow geological strata to admit frequencies lying between 50 and 80 vibrations/second, and rejecting lower frequencies. By the use of an arrangement of the invention a single shot will reproduce with clarity the entire record, including the first true beginning of the true wave, the first reflected seismic waves from shallow geological beds, the intermediate reflected seismic waves from deeper geological beds and the latest reflected seismic waves from the deepest geological horizons. Employing this method, it is possible to obtain usable records which can be analysed of all geological strata with a single shot. B. F. N. M.

550.834 : 608.3

Method and Apparatus for Seismic Electric Prospecting. U.S.P. 2,054,067. L. W. Blau and L. Statham. 15.9.36. This invention relates to seismic-electric prospecting, more particularly to the use, in seismic prospecting, of the effect of seismic waves upon the electric constants of the ground. In the art previously practised transverse waves cannot be eliminated by mechanical, acoustical or electrical filters in areas where the higher frequencies of the longitudinal waves are absorbed leaving only their low frequency waves. The seismograph obtains an indication of the actual motion of the ground on which a detector of small dimensions is placed. The average seismograph customarily used has a diameter of about 3 in. Such a seismograph is responsive to wave energy arriving over the area of the seismograph, say 10 sq. in. or less.

It is claimed that the arrangements used in this invention respond to waves arriving over large volumes of ground simultaneously. The waves arriving over areas several hundred feet long such as 200 ft. or longer are recorded. Thus the devices are adapted for the recording of reflections. The electrical current lines are substantially horizontal, consequently the receiving station is more sensitive to waves arriving in a vertical direction than to direct and surface waves. Therefore the recording station is particularly sensitive to reflected waves. Twenty-eight claims. B. F. N. M.

Drilling.

622.242 622.276

1278. Review of Drilling and Production Practice in California. W. A. Sawdon. *Petr. Eng.*, Sept. 1936, **7** (13), 87.—Drilling and production methods have continued their forward advance, and the industry has continued to become more and more scientific. Proration came into the limelight just over a year ago, and this, with the market and price structure, have considerably influenced the situation. The future reserves of the State have been increased by the opening of new fields, the extension of old ones and the development of deeper sands.

Geophysical exploration is being put to greater use.

No depth records have been broken during the past year, but deep-drilling technique has been advanced by the completion of wells to depths greater than 8000 ft.

L. V. W. C.

622.242

1279. Unitised Drilling Equipment Enables Oil Company to Effect Large Savings. N. Williams. *Oil & Gas J.*, 27.8.36, **35** (15), 40.—By assembling drilling equipment into unitized sections, each mounted upon skids, substantial savings in tearing-down and

setting-up time can be effected. As little as 12 hrs. is all that has been necessary to set up and start drilling in some instances. The main units in these sectionized rig set-ups are: derrick substructure, engine and draw-works, mud pumps, boilers, boiler-feed pumps and pipe rack. In addition, accessories such as fuel tanks, water tanks, etc., are set up permanently on skids and are skidded without dismantling to any part of the field. L. V. W. C.

622.242

1280. Modern Rigs and Drilling Methods. E. S. Post. *Oil Weekly*, 21.9.36, **83** (2), 34.—Drilling records are being made in the Lopez field, N.W. Texas, resulting from the use of advanced drilling methods and improved drilling equipment. These records have resulted from system, good machinery and proper maintenance, as all types of drilling equipment are being employed in the field. A diesel electric unit and a light gasoline set up are attracting most attention. The derricks used with the diesel electric rig are 66-ft. pumping derricks, and these are left standing when the well is completed for future work on the producer. With the light gasoline set up the derrick is 86 ft., enabling thribbles to be used. L. V. W. C.

622.242 622.276

1281. Progress in Drilling and Production Methods. K. C. Sclater, *Petr. Eng.*, Sept. 1936, **17** (13), 28.—The stable state of the industry resulting from the conservation programmes in force has enabled operators to concentrate more on improving field practices. Improved methods of well completion are among the important advancements and wells completed under controlled pressure are enabled to produce without interruption while drilling—in proceeds. There is an increasing trend towards unitized power units. Superheaters and direct-reversing diesels are other interesting developments. Portable steam drivers are being developed. A more efficient use of cement for shutting off water and the use of sodium silicate drilling mud are to be noted. L. V. W. C.

622.242 661.184.3

1282. Rodessa Serving as Proving Ground for New Drilling Rigs. M. Tucker. *Oil & Gas J.*, 10.9.36, **35** (17), 38.—The Rodessa field is the most active deep area in the world, and has become the proving ground for deep-drilling methods and equipment. Mud conditioning is playing a large part in overcoming the difficulties caused by the anhydrite zones penetrated, and acidizing has been found to react satisfactorily on all the muds encountered. L. V. W. C.

622.242.2 : 621.16

1283. Steam Power Efficiency. Anon. *World Petr.*, 1936, **7**, 227–248.—A short article dealing with closed-type and open-type feed-water heaters; integral and separately fired superheaters; multi-stage high-speed steam turbine and steam-engine prime movers for slush pumps; separate steam-engine drive for rotary table, introduced during recent years with the object of conserving heat in oil-field steam boiler plant. W. W.

622.242.2 : 621.16

1284. Steam-Power Plant Design and Operation. D. J. Shrimpton. *Petr. World*, (LA), 1936, **33** (3), 50.—Discusses the various items entering into a modern, well-balanced industrial steam-power plant, and shows how proper selection and adaptation of equipment make for a reliable, easy operating and economical plant. W. W.

622.242.2 : 621.16

1285. New Steam Hook-up Used to Drill Well in Kansas. W. T. Zugenhain. *Oil & Gas J.*, 13.8.36, **35** (13), 32.—The new steam rotary drilling rig being used by the Continental Oil Co. in Rice County, Kansas, affords an unusually high degree of compactness, flexibility in operation and ease of moving. Two vertical steam engines are mounted on one base and arranged to operate independently, whereby one drives the

rotary table, the other the pump, or they may be coupled together to operate the draw-works. The rig hook-up includes the most modern steam generating plant, superheater, draw-works and derrick assembly. L. V. W. C.

622.242.2 : 621.16

1286. New Rotary Uses Three Twin-Cylinder Engines. T. P. Sanders. *Oil & Gas J.*, 27.8.36, **35** (15), 58.—An up-to-date rig, using three vertical, twin-cylinder steam engines, is in use in the Rodessa field. Each engine serves for only one purpose, the largest driving the draw-works through a dual chain drive. The rotary table is driven by direct-shaft drive from a smaller vertical twin-cylinder engine, and the mud pump is driven by belt drive by a third vertical engine identical to the rotary table engine. Brantly feed control is being used, and this device controls the rate at which the drill pipe and bit are lowered when drilling. L. V. W. C.

622.242.2 : 621.313.1

1287. Electric Power for Drilling in Jungle or Desert. W. G. Taylor. *World Petr.*, 1936, **7**, 229–231.—Outlines various ways of utilizing diesel-electric drive for rotary drilling rigs with consideration to factors which affect the choice of layout and arrangement of engines and generators. W. W.

622.242.2 : 621.313.1

1288. Diesel Electric Drilling. E. J. Herzog. *World Petr.*, 1936, **7**, 232–235.—Discusses the advantages of diesel electric drilling over straight diesel drilling, and compares the use of alternating current with direct current for the transmission. From the advantages obtained by A.C. and D.C. systems it is considered that the drilling and hoisting characteristics procurable from D.C. equipment favour this system as being the better method of drilling. W. W.

622.242.2 : 621.313.2

1289. Powering Direct-Current Rigs. W. C. Lane. *Oil Weekly*, 24.8.36, **82** (11), 19; *ibid.*, 7.9.36, **82** (13), 40; *ibid.*, 14.9.36, **83** (1), 30.—The author explains in some detail the theory of the current method of applying direct-current electrical energy to the work of rotary drilling and deals with the application of the theory to the control of the rig.

The selection and operation of generators are dealt with in the second article. In normal drilling more power is required to operate the pump than is used to drive the drill pipe, and, as a result, the pump generator should be two or three times the drilling generator. One way of solving the unequal load problem is to use more than two generators of an equivalent capacity and to assign more than one to drive the pump load and one or two to drive the rotary.

The final article deals with the layout of existing direct current rotary drilling rigs. L. V. W. C.

622.243.5

1290. Review of Controlled Pressure-Drilling Method. J. S. Ross. *Petr. Eng.*, Sept. 1936, **7** (13), 116.—Drilling producing formations by the controlled pressure method is now in common use in a number of low-pressure areas. The principal difference between this method and the conventional rotary drilling practice is that oil or a mixture of oil and gas is used as a circulating medium instead of mud. Rig means of a packing arrangement between the drill pipe and the casing the flow from the well is confined to a closed system of surface lines and tanks and control on the fluid maintained. By retaining the wall in a " live " condition its capacity to produce is obtained continuously. The work of the geologist is simplified as the cuttings coming to the surface are uncontaminated with mud. Less cleaning out is necessary on wells completed by the system after they are on production, due, it is assumed, to the fact that during drilling the wells are flowed at their full capacity and all loose sand from the walls is cleaned out before the walls are completed. L. V. W. C.

622.243.5

1291. Michigan Operators Face Troubles when Drilling to Deeper Strata. W. T. Ziegenhain. *Oil & Gas J.*, 3.9.36, **35** (16), 26.—Rotary drilling is becoming of increasing importance in the gas areas of Michigan to drill through the glacial drift that overlays the greater part of the State. It will be necessary to use exceptionally tough rotary bits to explore the lower depths, and it may be necessary to find some new method of drilling or to alter the cutting edge of the bit to pierce the granite and hard limestone encountered. L. V. W. C.

622.243.7

1292. Correcting Crooked Holes by Use of Fibred Cement. T. P. Sanders. *Oil & Gas J.*, 3.9.36, **35** (16), 42.—Fibred cement for plugging back crooked holes has been used with considerable success. The addition of the fibre to cement causes a change in the physical properties. The fibred cement does not enter the formation readily, thus acting as a seal. In addition, it has been proved that fibred cement is more efficient in deflecting a bit than is heat cement, due to a cushioning action of the teeth of the bit by the fibrous material.

No failures have been recorded to date, although fibred cement has been used mostly on wells where adverse conditions called for special attention. L. V. W. C.

622.245.1

1293. Casing of Deflected Hole Completed on Coastal Wildcat. N. Williams. *Oil & Gas J.*, 20.8.36, **35** (14), 43.—The task of casing a deflected hole was recently accomplished in the Texas Gulf Coast, the job involving the exertion of special precautions to prevent the pipe from sticking before getting it down and to ensure placing the cement. The hole is 37 degrees off vertical, and into this hole a full string of 5-inch casing was run to 8659 ft., and cemented with 200 sacks of cement. A newly developed cement was used, as the temperature at the bottom was 206 degrees, and this would cause ordinary cements to set before being placed. In order to allow the casing to run smoothly, the bottom portion was made up of flush-joint pipe. It was necessary to keep the pipe moving, and after reaching the shoe of the previous string the casing was inserted as thribbles. The thribbles were made up and stacked ready for use. No time was lost in placing the cement plug container, hanger and landing nipple for the cementing job. L. V. W. C.

622.245.42

1294. Generation of Heat in Cement Hardening. R. I. Grozdovskaya and E. A. Yaichnikova. *Nov. Tekhn. Bur.*, 1936, **4** (2), 5–6.—As a result of experimental investigation, it is stated there is a relationship between the amount of $3CaO,SiO_2$, the strength and the amount of separated heat. The higher the content of $3CaO,SiO_2$ in the cement, the greater is its strength and the more heat is produced. An increase in the water added during the preparation of mortar lowers the amount of heat separated. A maximum of heat separation is observed after 7–9 hrs. for a 25% consistency, and after 10–13 hrs. for a 40–50 and 60% consistency, although this depends on the temperature of the surrounding medium. The higher the temperature of the latter the more rapidly is reached the maximum of heat separation. There is no relationship between the time of setting and the time of heat separation. The equilibrium between the heat released by the cement and the heat transferred to the surrounding medium is established within 1–3 hrs. This applies to a high-grade cement containing Ca-aluminate. Cements with a low content of the latter and a high content in ferrites set very slowly, and do not show the dependence mentioned above.

For. Petr. Techn.

622.248.1

1295. Subsurface Photography Used to Aid California Fishing Job. N. Williams. *Oil & Gas J.*, 13.8.36, **35** (13), 29.—The first fishing job to be accomplished with the assistance of photography occurred in the Long Beach Field in California. A special camera was built, and successfully photographed the obstructions which were preventing the fishing job from being completed, facilitating their removal.

L. V. W. C.

622.248.34

1296. Salt Water under High Head Creates Problems in Gulf Coast Well. N. Williams. *Oil & Gas J.*, 6.8.36, **35** (12), 37.—Heaving shale conditions encountered in a well in the Texas Gulf Coast area have created some unusual problems. The sand to which this hole has been drilled has been found to contain water with a high hydrostatic pressure and some gas coupled with heaving shale. 802 ft. of 9-in. lines were set with the top at 5928 ft., and this was cemented. On drilling farther, the well blew out when the drill had reached 6742 ft. The core barrel was blown upwards in the drill pipe, making it impossible to remove it, and circulation was stopped when the shale followed up the drill pipe. The blow-out preventer prevented the well from getting out of control through the casing.

To clean down the drill pipe a string of 1¼-in. pipe was used with a small diamond bit on the bottom. Little rotation was necessary, and, after cleaning, the 4-in. drill pipe was pulled up and circulation was obtained. The drill pipe was then pulled up into the 11¾-in. casing and the well allowed to blow. Salt water was produced, showing that water was still coming into the hole, and that the top of the line was open. Efforts are now being made to shut off the water pressure. L. V. W. C.

661.184.3

1297. Drilling Muds. K. H. Clough. *Petr. Eng.*, Sept. 1936, **7** (13), 161.—The properties and methods of treating drilling muds are discussed, and the chief functions of a rotary drilling mud are outlined. L. V. W. C.

661.184.3 622.245.42

1298. Mud Conditioning and Cementing Offer Problem in Louisiana Deep Wildcat. M. Tucker. *Oil & Gas J.*, 6.8.36, **35** (12), 30.—Four prolific gas horizons were encountered in the deepest Wildcat being drilled in N. Louisiana before a depth of 8300 ft. was reached. These were cased off, and the 6⅝-in. pipe was run and cemented just below the fourth horizon. A troublesome mud condition was experienced prior to the running of this string. It was found to be difficult to release the gas in the mud, but by the addition of chemicals and weighting material the gas-cut mud was able to dispel much of the gas in solution. A mud gun operating at the point of discharge from the well assisted.

Another trouble ensued when penetrating the anhydrite, but by careful conditioning of the mud the change in the physical properties of the mud-laden fluid was counteracted. Special cement was used to cement the 6⅝-in. string. This cement has a retarding action of about 4 hrs. L. V. W. C.

622.245.7 : 608.3

1299. Patents on Drilling Equipment. J. W. MacClatchie. U.S.P. 2,051,261, 18.8.36. A rotating blow-out preventer.

622.24.051.5 : 608.3

P. Liddicoat. U.S.P. 2,051,306, 18.8.36. Detachable-head drilling bit.

622.276.2 : 608.3

D. G. Lorraine. U.S.P. 2,051,307, 18.8.36. Air adjustable surface flowbean.

622.245.2 : 608.3

W. J. Flury. U.S.P. 2,051,521, 18.8.36. A pressure bailer having a bailer casing at the lower end of the string and a sand chamber with shoe for engaging bottom of well. A valve is placed at the lower end of the bailer casing to maintain this casing in an air-tight condition. Means for opening valve and allowing high-pressure in sand chamber to enter low-pressure chamber.

622.24.051.5 : 608.3

J. H. Howard. U.S.P. 2,051,525, 18.8.36. Rock drill bit.

622.245.1 : 608.3

J. H. Howard. U.S.P. 2,051,713, 18.8.36. A set shoe in combination with a downwardly opening check valve and a slidable valve member in the valve body. Ports adapted to be opened and closed by movement of this valve member and sealing members adapted to seal between the valve and valve body when ports are closed.

622.24.051.59 : 608.3

S. Siracusa. U.S.P. 2,051,911, 25.8.36. Rotary Jar.

622.245.2 : 608.3

C. C. Taylor. U.S.P. 2,052,006, 25.8.36. A well-cleaner consisting of two well casing packers secured in spaced relation on a string of well tubing with a third packer between able to slide on the tubing. Means provided to anchor it at some definite point within the perforated casing and means to prevent flow of fluid through port to preserve suction between the packers.

622.24.051.55 : 608.3

J. V. Pennington. U.S.P. 2,052,034, 25.8.36. Roller bit.

622.24.053 : 608.3

L. C. Black. U.S.P. 2,052,075. 25.8.36. Oil well travelling block in which the ball bearings serve as the sole means to lock and maintain the sheaves in spaced assembled relationship.

622.245.44 : 608.3

G. Meyer. U.S.P. 2,052,786, 1.9.36. Well Packer.

622.245.7 : 608.3

H. C. Otis. U.S.P. 2,052,939, 1.9.36. A wellhead comprising a pressure sealed drilling head with rotating members to permit vertical passage of a flat-sided drill stem without loss of pressure and means to allow couplings to pass without loss of pressure.

622.245.13 : 608.3

E. V. Crowell. U.S.P. 2,053,065, 1.9.36. Tubing anchor.

622.245.42 : 608.3

L. T. Starr. U.S.P. 2,053,448, 8.9.36. An anchor plug in a well cementing assembly in combination with an axially movable and a radial expansible well plug.

622.276.4 : 608.3

C. J. Coberly. U.S.P. 2,053,602, 8.9.36. Bleeder for deep-well pumps.

622.276.4 : 608.3

A. Villers. U.S.P. 2,053,981, 8.9.36. A method for flowing wells consisting of a well casing having a number of holes communicating with fluid pressure zones. In the casing is a tubing relatively smaller than the interior diameter of the casing with a number of valves carried by the tubing adjacent to these openings. Means provided to prevent intercommunication between the pressure zones within the casing.

622.24.053 : 608.3

W. L. Childs and G. G. Harrington. U.S.P. 2,054,118, 15.9.36. Tool joint and method of manufacture.

622.24.051.5 : 608.3

J. H. Howard. U.S.P. 2,054,255, 15.9.36. Well drilling tool of the rotary type with a hammer action to force cutter downwards.

622.24.051.5 : 608.3

J. C. Wright. U.S.P. 2,054,277, 15.9.36. Stabilized well drilling bit.

622.245.2 : 608.3

J. C. Wright and J. H. Howard. U.S.P. 2,054,278, 15.9.36. Fishing tool having means for making an annular cut to form a core for reception by the body and pivoted dogs of different lengths operable to move under the fish on the core.

622.245.42 : 608.3

W. Creek. U.S.P. 2,054,314, 15.9.36. Cement bailer.

622.276.4 : 608.3

D. W. Haferer. U.S.P. 2,054,322, 15.9.36. Pump anchor.

622.245.7 : 608.3

A. J. Penick and K. I. Penick. U.S.P. 2,054,336 and 2,054,337, 15.9.36. Blow-out preventer.

622.245.42 : 608.3

O. P. Yowell. U.S.P. 2,054,353, 15.9.36. A method of shutting off intrusion from a water zone through a perforated casing of an oil well, consisting of forming open perforations in the casing in the region of the water zone and forming cement bridges in the formation surrounding the casing. Cement is forced under pressure into the formation.

622.248.2 : 608.3

H. Hanlon. U.S.P. 2,054,376, 15.9.36. Basket fishing tool having bendable teeth progressively increasing in length to permit first one tooth after another to come in contact with the bottom of the well.

622.245.2 : 608.3

E. R. Smith. U.S.P. 2,054,606, 15.9.36. Bailer.

622.245.2 : 608.3

W. J. Flury. U.S.P. 2,054,766 and 2,054,767, 15.9.36. Double-seated differential pressure boiler and automatic discharge relief valve. L. V. W. C.

Production.

622.245.593

1300. Acid Treatment of Michigan Oil and Gas Wells. R. B. Newcombe. *Drilling and Production Practice*, 1935, A.P.I. 97.—Reviews the development and use of acid treatment, and touches on some of the experiences in Michigan and some of the new experimentation which actual local field conditions have brought about. Acid treating involves three principal factors, namely: the type of acid, the amount of acid and the method of introduction into the hole. Each of these factors is dealt with. The writer also deals with accessory chemicals which have been developed to combat difficulties caused by water and paraffin in the formation, and to direct the acid where its reaction will do the most good, and outlines the economic success of acid treatment in this area. W. W.

622.245.593

1301. Progress in Well-Acidizing Practice. L. H. Towers. *Petr. Eng.*, Sept. 1936, **7** (13), 100.—New methods in the treatment of oil wells with acid during the past year have shown the variety of problems that can be solved by this means. Acidizing of new wells is being employed for the purpose of controlling reservoir energy, gas–oil ratio, oil–water ratio and for increasing the capacity of input wells used in salt-water disposal and water flooding operations. An acid treatment will lower the resistance to flow, decrease the pressure drop and permit a higher sub-surface flowing pressure. L. V. W. C.

622.276

1302. Gulf Coast Field Developed by Modern Production Methods. L. G. E. Bignal. *Oil & Gas J.*, 20.8.36, **35** (14), 38.—The Skilly Oil Co. of Tulsa has developed about 1200 acres of the Frio sand in the Bay City field, Texas, by the most modern methods. Conservation of oil, gas and reservoir energy is being practised as an economic measure, means have been provided for eliminating the usual waste of oil accompanying the bringing in of a well and the most modern methods of exploring for and drilling into the oil-sands are followed. L. V. W. C.

622.276

1303. **Twinning Operations.** T. P. Sanders. *Oil & Gas J.*, 20.8.36, **35** (14), 44.—On 44 locations in the Fitts field twin wells have been completed to tap the several highly productive horizons which have been declared separate sources of supply. Since no well is permitted to produce from more than one source of supply, and since the source of supply will produce oil for many years to come, twin and triplet wells are necessary for fully developing the field at this time. The wells are commonly drilled 50 to 80 ft. apart. L. V. W. C.

622.276

1304. **Benefits of Wider Well Spacing in Texas.** R. W. Byram. *Oil Weekly*, 7.9.36, **82** (13), 21.—Since 1919 a rule has been in operation allowing drillers to drill 150 ft. from lease or boundary lines and 300 ft. between wells except in those fields where special rules exist. Operators have been notified that this system is to be changed and wells will be drilled 330 ft. from lease lines and 660 ft. apart, or one well to 10 acres.

It is expected that as a result of this change proration control will be easier, development expense will be less and a higher allowable per well will be possible.

L. V. W. C.

622.276

1305. **Producing Heavy Oil.** Anon. *Oil Weekly*, 24.8.36, **82** (11), 35.—Special methods are required to produce the unusually heavy grade of oil found in the Santa Barbara County, California. This oil has a gravity of 8° A.P.I. and is entirely free from paraffin wax.

The oil is easily brought to the surface either by natural flow or by pumping but congeals rapidly upon being exposed to atmospheric temperature.

Several methods have been used to keep the oil sufficiently fluid so that it can be pumped from the stock tanks. Steam lines have been popular, but one interesting method is to mix with the heavy oil a given quantity of lighter kerosine distillate. This has successfully overcome the problem. One part of kerosine distillate to two parts of heavy crude is the ratio of mixing. L. V. W. C.

622.276.2

1306. **Reservoir Pressure held by Returning Gas Removed from Oil.** L. G. E. Bignell. *Oil & Gas J.*, 30.7.36, **35** (11), 83.—With a view to saving natural gas in the production of crude oil, J. A. Zublin has devised a gas extractor. The apparatus, which permits a conservation of gas, also permits a saving in equipment costs for producing the oil. The quantity and size of all gas-handling equipment will be reduced, since the production of gas is more uniform over the life of the well. Large compressors for gas injection and repressuring are not necessary when the device is in use, since the theory is that the gas liberated into the space above the oil will find its way back into the formation and continue to repressure or recharge it, and so tend to drive the oil downward and out into the lower portion of the hole. L. V. W. C.

622.276.2

1307. **Special Equipment is used to Control High-Pressure Wells in Moore Pool.** L. G. E. Bignell. *Oil & Gas J.*, 13.8.36, **35** (13), 48.—Special heavy equipment has been designed to control the large, high-pressure wells in Northern Cleveland County, Oklahoma. Above the upper end of the 7-in. casing five 7-in. 5000-lb.-pressure master gates are mounted. A cushion head, lined with lead in the top, is mounted above the master gate provided with one 15¼-in. outlet from which the gas, oil and sand escape to the heavy dirty sand trap set near the well. The separator is also lead lined on the side opposite the opening for the flow line. The back pressure held on the trap ranges from 80 to 50 lbs. in one case and from 30 to 10 lbs. in another. In controlling the wells during flow period the upper gate is partly closed, and as it cuts from the sand passing through it with the oil the second gate is partly closed, and with an appreciable pressure drop it is possible to close completely the lower three gates and bring the well under control. L. V. W. C.

622.276.2

1308. Wild Gulf Coast Gases Easily Subdued. L. G. E. Bignell. *Oil & Gas J.*, 3.9.36, **35** (16), 43.—Recently a deep high-pressure well got out of control in the Tepetate field, S. Louisiana, when a formation tester stuck in the casing. The gas under a pressure of about 3200 lbs. blew up the string of tubing to which the tester was attached and one of the rotary hose coupled to the upper end of the tubing. The blow-out preventer prevented the gas from escaping through the annular space between the tubing and casing and the whole flow of gas was through the tubing and out of the rotary hose into the atmosphere.

Control could not be obtained until the tubing was cut off above the turntable. To accomplish this two trucks with power-winches were backed up near the derrick and a wire rope run around the tubing and wound backwards and forwards until the tubing was cut.

The tubing could not be moved and a special head had to be put into place to close the open end tubing. Mud fluid was then pumped into the well until the flow was killed. L. V. W. C.

622.276.2

1309. Progress in Bottom-Hole Choking. H. C. Otis. *Petr. Eng.*, Sept. 1936, **7** (13), 31.—A review is given of the past year's developments in the use of bottom-hole chokes. In addition a description is given of a new type of removable bottom-hole choke for controlling the rate of gas admission into the tubing when flowing weak oil wells. This new type of choke permits the introduction, under control, into the tubing of gas from the annular space between the tubing and the casing. In effect it is a removable jet collar. L. V. W. C.

622.276.4

1310. Difficulties in Pumping Deep Oklahoma City Wells being Overcome. T. P. Sanders. *Oil & Gas J.*, 6.8.36, **35** (12), 38.—Practically all the old wells in the Oklahoma City field are now being pumped, showing that the difficulties originally encountered due to great depth, large amount of gas and the production of sand have been overcome. Sucker rods presented the most trying problem, but the substitution of 1-in. rods for the top 2000 ft. of tubing in place of the $\frac{7}{8}$-in. rods previously used has produced some improvement. Considerable trouble has been experienced from sand, but in many instances this trouble has been reduced by plugging back to shut off water in the lower part of the Wilcox sand and shooting the upper part with nitroglycerin. In one instance production was increased very considerably.

L. V. W. C.

622.276.4

1311. Graphic Method of Analyzing Dynamometer Cards. J. C. Slonneger. *Petr. Eng.*, Sept. 1936, **7** (13), 155.—A dynamometer card of a pumping well gives a record of the mechanical behaviour of the entire lifting mechanism. A simple rapid method of analysis by graphic means is described and this method will aid in a better understanding of pumping problems. L. V. W. C.

622.276.4

1312. "N" Value and its Relation to Practical Compressor Problems. J. Rogers. *Petr. World* (LA), 1936, **33** (4), 71.—Based on a combination of theory and practical experience, this article describes in plain terms what takes place in a compressor when it handles a specific type of gas, how to prepare to handle gases of unknown qualities and states useful facts of interest to compressor-plant operators. The effect which the "N" value of a gas has on the performance of a compressor is clearly explained.

W. W.

622.276.4

1313. Large Pumping Unit on Michigan Brine Well. R. C. Conine. *Oil & Gas J.*, 6.8.36, **35** (12), 28.—A large pumping unit of oil-field type has recently been installed

in the Michigan field to increase brine production of the Rademaker Chemical Corporation. The well which the unit is pumping is 2500 ft. deep and the pump has a 4½-in. I.D. working barrel 10 ft. long equipped with a 4-cup travelling valve, a 2-cup standing valve. The sucker rods are 1-in. chrome molybdenum steel and 1800 ft. of seamless casing, $5\frac{9}{16}$-in. in diameter, is used as tubing. Owing to the load on the polished rod, special surface equipment was necessary.

Slow pumping speed is practised, and this necessitated two-speed reductions between the prime mover and the crank shaft. The speed of pumping is eleven strokes per minute. L. V. W. C.

622.276.4

1314. Recent Developments on Water Flooding Practice in the Bradford Field. A. C. Simmons. *Petr. Eng.*, Sept. 1936, **7** (13), 124.—New developments are continually being made in the forced water-drive methods, and a number of these are outlined. A vapour-recovery system which enables the national gas dissolved in the oil to be recovered and used as fuel has been introduced. Examination of cores is becoming standard practice, and core reports have been valuable aids in the prevention of uneconomic development. The water-supply problems are being dealt with as well as efficient water treatment to correct undesirable characteristics. L. V. W. C.

622.276.4

1315. Modern Practices Followed in Bradford Field Flood Project. T. P. Sanders. *Oil & Gas J.*, 17.9.36, **35** (18), 42.—In the Bradford field an old 60-acre oil-producing lease has recently been turned over to water flooding. The "five spot" plan has been adapted, all wells being 250 ft. apart. Coring of the water and oil wells has been carried out throughout the entire section and the cores are tested for permeability porosity and saturation. The water to be used for flooding is filtered and chlorinated to destroy certain organic materials. The wells are pumped by straight-lift jacks actuated by a central power. L. V. W. C.

622.276.4

1316. Many Factors to be Considered in Water Flooding. H. M. Ryder. *Oil & Gas J.*, 27.8.36, **35** (15), 50.—Second recovery operations, with water as the repressuring medium, have been proceeding for some time in N.E. Oklahoma with some definitely optimistic results. The permeability of Mid-Continent sands is in general higher than that found in the eastern flooding districts. As a result, pressures may be kept lower, well spacing increased and the rate of flooding will tend to be much greater. The production should be greater per well and possibly for a shorter life.

L. V. W. C.

622.276.4

1317. Accelator Water-treating Process Installed on Four Flood Projects in Nowata Area. P. Reed. *Oil & Gas J.*, 13.8.36, **35** (13), 24.—Two companies in the Nowata Area has installed the recently developed Accelator system of treating water before it is pumped into the wells for flooding purposes. This system permits only clear water to be pumped into the oil-sands and prevents dissolved substances such as iron oxide, which on contact with air, are precipitated, from being carried over. A large amount of carbon dioxide is released during the passage of the water through the plant, and the solution is left supersaturated with calcium carbonate as a result. This is a step towards preparing for later precipitation in the reaction and settling basin. The removal of carbon dioxide by aeration also eliminates the subsequent corrosion in pipe-lines of the distributing system. L. V. W. C.

622.276.95

1318. Progress in Gas-Lift Practice, 1935–1936. S. F. Shaw. *Petr. Eng.*, Sept. 1936, **7** (13), 62.—A review of the progress in gas-lift practice during the last year is given. Little change in the regular practice has been made, but improvements in the older methods are to be noted. The principal development during the year has

been the use of the gas-lift Reda pump combination method for handling large production in deep wells where reservoir pressure is low. L. V. W. C.

622.276.53

1319. Large Gas-Lift Plant. J. C. Albright. *Oil Weekly*, 24.8.36, **82** (11), 32.—With a decline in pressure in the Wilcox sand area, Oklahoma City, the Westgate Oil Company erected the largest straight gas-lift plant in this area and one of the biggest in the world. The plant has 24 compressor units. By means of labour-saving equipment and the use of high-quality automobile motor oil for lubrication, the company is able to operate the plant with five men only per shift.

The use of high-grade lubricating oil has resulted in less shut-down time, and the workmen can, therefore, attend to all duties comfortably. L. V. W. C.

Transport and Storage.

621.642.34 : 620.197.7

1320. Cathodic Protection of Tank Bottoms. D. Sneigr. *Oil Weekly*, 14.9.36, **83** (1), 50.—The Texas Pipe-Line Company has evolved a method of protecting storage-tank bottoms from electrolytic corrosion. Insulators have been installed at the gate valves leading to each tank. These insulators consist of three-ring gaskets, two composed of high dielectric fibre and the third of sheet steel. The electric currents which cause the corrosion cannot pass beyond the insulators, and to assist still further, the line which leads from the main pipe-line to the tank farm is raised horizontally above the ground for a distance of 75 to 150 ft. L. V. W. C.

622.324.5 : 658.787.8

1321. Pulsating Problems in Measuring Natural Gas. F. B. Taylor. *Oil Weekly*, 14.9.36, **83** (1), 27.—Pulsating problems in measuring natural gas may be overcome by the application of a number of corrective factors. A straightening vane may be used to smooth out pulsations. The swirling motion of the gas stream is re-formed into one constant flow. It frequently happens that vanes are not sufficient to reduce pulsations, and a combination of resistance and capacity is generally the most effective means. Various manifolds, with staggered cross-sections, and with a total volumetric capacity equal to or greater than the transmission line, have been used to advantage. Where pulsations are of great magnitude it may be advantageous to change lines completely. L. V. W. C.

622.698

1322. Oil Pump Developed by Gulf Process Successful in Pipe-line Service. P. Reed. *Oil & Gas J.*, 13.8.36, **35** (13), 52.—The author describes in detail the Pigott pump, which is a new departure in oil-field practice, and which has shown remarkably high volumetric efficiencies. Briefly it is an eight-tooth pinion rotating within a nine-tooth ring gear. L. V. W. C.

622.698

1323. Pipe-line Station Operation. E. Sterrett. *Petr. Eng.*, Sept. 1936, **7** (13), 54.—A summary of the advance made in pipe-line station operation showing that the majority of new units were put into existing stations for increasing capacities or to take care of extensions to existing lines. Cleaners for intake air for diesel or gas engines are the accepted practice in East Texas, and adequate filtering and cooling or, for winter operation, warming provision on the lubricating system have proven additional aids to better engine performance. The provision of proper packing has reduced the need for such frequent gland attention. There is a widespread trend towards rigid scheduling of scraper runs through all crude carrying main lines. L. V. W. C.

622.698

1324. Pipe-line Transportation Systems and Electric Power. W. C. Dreyer. *Petr. Eng.*, Sept. 1936, **7** (13), 36.—A review of the more important developments in the application of electric power and equipment to pipe-line operation. L. V. W. C.

622.698

1325. **Progress in Gas Transmission and Compressor Station Operation.** R. W. Parker, *Petr. Eng.*, Sept. 1936, **7** (13), 74.—The trend in gas transmission has been towards more efficient and economical operation of transmission systems and to the improvement in accepted prime movers employed in compressor stations. L. V. W. C.

622.698

1326. **Leak Reconditioning on Large-diameter Gas Lines.** L. A. Ellis. *Petr. Eng.*, Sept. 1936, **7** (13), 50.—The Houston Pipe-line Co. found that one source of wasted effort was the repeated uncovering of highly corrosive spots due to new leaks appearing where the pipe had previousiy been uncovered for repair. It was found that an electro-chemical action was set up between the pipe and the clamp placed on the pipe to repair a leak, and it was decided to apply a coating to this spot to insulate completely the clamp from the pipe. A satisfactory coating had to be found to comply with certain conditions, and it is reported that the problem was solved by accident. L. V. W. C.

622.698

1327. **Progress in Electric Welding of Pipe-lines.** A. F. Davis. *Petr. Eng.*, Sept. 1936, **7** (13), 42.—The greatest forward step in welding of oil pipe-lines during the past year has been the extended use of plain butt joints without backing-up ring on the straight end-pipe. Sections of the line welded up in this manner are tied into the line by bell-hole welds. Large savings are reported by the use of plain butt joints are welded without backing-up rings. L. V. W. C.

622.698 : 620.197

1328. **The Use of Non-Ferrous Metals Underground.** K. H. Logan. *Oil & Gas J.*, 24.9.36, **35** (19), 137. A series of tests has been carried out by the Bureau of Standards on the corrosion in soil of 9000 specimens of pipes and fitting and 1000 specimens of metallic protective coatings. The loss of weight and rate of penetration of pits of some of these specimens in different soils after 10 years is tabulated. The general conclusions reached were as follows:

Aluminium. Duralumin corroded at the surface in localized or generally distributed pits. Commercial Al and AlMn alloys in some soils may form blisters under which corrosion may be serious, but measurements of the extent of this corrosion are difficult. The data are generally insufficient to justify general conclusions; but it is suggested that caution should be taken with Al and Al alloys in unknown soils. Calorized pipe showed improved corrosion resistance.

Brass and Copper. These materials corrode very slowly, though perhaps at a constant rate; but brasses high in zinc show dezincification. Soils containing sulphides corrode copper and bronze rapidly, whilst brasses are more resistant. Muntz metal corroded more rapidly than other Cu alloys, whilst CuSi and CuNi alloys behave similarly to the brasses after two years, although a 40 : 10 Zn : Ni alloy corroded severely in the 10-year test. Copper-bearing steels corroded very rapidly.

Lead. In most soils lead corroded much more slowly than steel, being especially resistant to soils containing sulphates. However, in six soils which did not corrode steel severely, lead pitted more deeply than steel. High-purity lead is generally more resistant than other types of lead; but the character of the soil is more important than the composition of the lead. Lead-coated steel pipe in 13 out of 34 soils showed deeper pits than the steel pipes after 10 years, the more recently developed lead coatings showing little improvement. In soils containing sulphates where lead pipes showed good resistance, lead-coated pipes showed serious pitting, possibly due to galvanic action. A thick lead coating is obviously necessary to prevent penetration by the soil reaching the steel.

Zinc. Commercial, rolled and cast zinc gave similar results, being superior to steel but inferior to other metals, except chemical lead. Galvanized iron showed less corrosion than zinc or iron, except in tidal marsh soil. The rate of loss of weight for galvanized specimens increases with the period of exposure, so that galvanizing cannot be expected to give permanent resistance.

It is concluded that no ferrous metal will stand all soil conditions; but for each soil there are one or more alloys or metals of suitable resistance. Copper and brasses high in copper are suitable for soils free from sulphides and lead for soils containing sulphur compounds. Metallic coatings, of which zinc is the best, extend the life of the pipe but give only temporary protection.

It is therefore necessary to study the characteristics of the soil and select the most suitable metal for these conditions. C. L. G.

622.698 : 620.197.5

1329. Induced Current Along Pipe-lines Retards Corrosion. S. Thayer. *Oil & Gas J.*, 24.9.36, **35** (19), 91.—A description is given of the Rectox type of cathodic protection units which were originally used for the protection of pipe-lines from corrosion. These consisted of copper oxide disc rectifiers which were used to convert the A.C. current obtainable locally. 800 of these were used, stacked together, and 16 units have been used successfully since 1932. They are cheap and easy to instal and operate, and flexible to different load conditions, but depend on the availability of a reasonable cheap supply of electricity. These units have now been superseded by wind-driven generators. A typical unit described consisted of a 14-ft. propeller and a 70-amp. generator mounted on a 40-ft. tower. It was found that small generators with automatic control were not as successful as large generators allowed to remain permanently on the line, the propeller being removed during gales. Such units can be used wherever there are favourable winds, and at a low operating cost, and require the minimum of attention, but are limited in size and rather noisy. When winds are insufficient a gas-engine-driven unit can be coupled up. This provides more power than the wind-driven unit, but requires more attention. It can also be used only on gas lines, unless gasoline fuel is available. C. L. G.

622.698 : 620.197.5

1330. Cathodic Pipe-line Protection Increasing on Gold Coast. N. Williams. *Oil & Gas J.*, 24.9.36, **35** (19), 105.—A brief outline of the development of the cathodic protection of pipe-lines, and of the present status of the application of this process by different pipe-line companies, using wind-driven generator units. More than 60 units are in use with beneficial results, and many more are planned. C. L. G.

622.698 : 620.197.5

1331. Cathodic Protection of Pipe-line Systems. D. S. Sneigr. *Oil Weekly*, 31.8.36, **82** (12), 30.—An increased number of installations have been put into operation for the cathodic protection of pipe-line systems. Both wind- and engine-driven units are in use, and the wider application of such protection to equipment and the development of the diesel engine as a power means are the major developments in sight for the near future. L. V. W. C.

622.698 : 620.197.6

1332. New Development in Field Coating of Pipe. H. B. Mayes. *Oil Weekly*, 31.8.36, **82** (12), 21.—A new development in field coating of pipe is the central plant. The stationary cleaning, coating and wrapping equipment is of a portable nature, and is carried to some site adjacent to laying operations.

The central coating plant is an intermediate between the field and well applied coatings, and eliminates the inefficiency of the field applied jobs to a great extent. L. V. W. C.

629.123.24

1333. A Study of Wastes. J. Bennasar, *Oil Weekly*, 21.9.36, **83** (2), 34.—The author analyses the causes that often bring about excessive losses during transportation of petroleum and its by-products between the points of shipment and destination and during loading. A plan for reducing these losses is discussed. L. V. W. C.

656.073.27

1334. Combatting Tank Fires at Oil Storage Tank Farms. J. A. Kornfeld. *Petr. Eng.*, Sept. 1936, **7** (13), 163.—Modern methods of fire-fighting in use at oil-tank farms comprise the use of cannon to combat "boilover," the use of steam to fight flames, the exhaustion of oil from tank during fire and the erection of firewalls.

The use of cannon to combat "boilover" is not resorted to until all other precautions have been taken. The object of shooting is to spread the boiling oil over as large an area within the firewall as possible. At least 4 hrs. are allowed to elapse before cannon are used. The instant that the shot penetrates the tank the "boilover" diminishes. L. V. W. C.

Chemistry of Petroleum.

547.21 : 66.095.21

1335. Isomerisation of *n*-Hexane and *n*-Octane with Aluminium Chloride. B. L. Moldavskii, M. Y. Kobuil'skaya and S. E. Livshitz. *For. Petr. Techn.*, 1936, **4**, 403–415.—Experiments are described on the separate treatment of the above hydrocarbons with 3–10% $AlCl_3$, alone, and with added propyl chloride, HCl, and compounds of HCl with anhydrous sulphates of lead and copper. The temperature and duration of the treatment varied in the ranges of 20–90° C. and 1–24 hrs. respectively. Up to 25% of *iso*-compounds were found to be present in the treated hydrocarbons. It was concluded that: (1) isomerization by means of $AlCl_3$ was greatly activated by HCl or by substances able to split off the latter and permitting the reaction to proceed at a considerable velocity even at room temperature; (2) in the absence of HCl or other activators the isomerization proceeds at a noticeable speed only at elevated temperatures, whereby at the beginning an induction period is observed; (3) an increase of the surface of the $AlCl_3$ and agitation accelerate the reaction of isomerization. G. R. N.

Analysis and Testing.

535.34

1336. Handling Absorption Tubes in Carbon and Hydrogen Determinations. D. F. Hayman. *I.E.C. Anal.*, 1936, **8**, 342–343.—A method of handling and weighing absorption tubes has been developed, which includes the following features: (1) location of the balance in a room kept at a fairly constant temperature; (2) use of simple Pregl absorption tubes; (3) weighing tubes immediately after wiping to eliminate the necessity of closing the ends of the tubes; (4) saving about 10 minutes on each analysis; (5) use of a special background for viewing absorption tubes during cleaning and (6) elimination of static charge on the glass surface, by proper wiping, and, still more important, by maintaining the relative humidity of the laboratory at or above 45%. G. R. N.

541.24

1337. Physical and Chemical Properties of Petroleum Fractions. Part I. H. T. Rall and H. M. Smith. *I.E.C. Anal.*, 1936, **8**, 324–330.—This part deals with the mol. wt. in dilute benzene solutions using a modified Beckmann apparatus and method developed by the U.S. Bureau of Mines. Results are given for oils having mol. wts. of approx. 200, 300, 500 and 700. Comparative cryoscopic data from eleven laboratories for the same oils in benzene solution are given and discussed. Data are presented showing that impurities and moisture exert adverse effects on mol. wt. determinations. The presence of impurities probably at least partly explains the discrepancies universally found in cryoscopic determinations of the mol. wts. of oils. It is stressed that what is determined is a variable called "mol. wt.," which represents the state of molecular aggregation of the oil in the solvent at the concentration in effect at the time. Twenty references. G. R. N.

541.24

1338. Microvapormetric Determination of Molecular Weight. J. B. Niederl, O. R. Trautz and A. A. Plentl. *I.E.C. Anal.*, 1936, **8**, 252–255.—A previous described micro-method for vapour-density determination has been suitably modified to include

high-boiling liquids and solid substances. The apparatus consists of a 350-ml. flask with a tangential neck fitted with a condenser used as a bath, and an egg-shaped vaporizing bulb, placed centrally in the flask, with the stem leaving the flask at an angle of 45°. An air condenser and receiver are fitted to the bulb. Mercury is used as the displacement fluid in the bulb. Complete instructions and method of procedure are given. Thirty-eight references. G. R. N.

532.13

1339. New Test Method proposed for Kinematic Viscosities. Anon. *Nat. Petr. News*, 15.7.36, **28** (29), 25.—A complete draft of the specification for the proposed modified Ostwald Pipette and the method of use is given. The publication is made by Committee D2, of the A.S.T.M. for the purpose of criticism. The modified pipette differs from the conventional one, chiefly in that, by suitably bending the capillary arms, the reservoir bulbs have their centres in the same vertical line. The pipettes are available in nine sizes to cover the viscosity range of 0·9–1200 centistokes. Four pipettes cover the range of lubricating oils. H. G.

532.13

1340. Extension of the Range of Concentric Cylinder Viscometers. L. Squires and R. L. Dockendorff. *I.E.C. Anal.*, 1936, **8**, 295–297.—Using a graph relating friction factor and specific Reynolds number, it has been found possible to determine the viscosity of liquids in a concentric cylinder viscometer even when the liquids are so fluid that their motion is turbulent during the determination. While the method becomes more inaccurate as turbulence increases, satisfactory results can be obtained with the Stormer or MacMichael viscometer for liquids as fluid as water. G. R. N.

532.13

1341. Modification of the Suspended Level Viscometer. E. H. Payne and C. C. Miller. *I.E.C. Anal.*, 1936, **8**, 300–302.—The Ubbelohde suspended level viscometer modified by Fitzsimons was further improved by including a metal manifold for connection to suction lines and a connection for draining or filling with oil from the bottom. The calibration of the instrument to obtain kinematic viscosity values was carried out by testing three standard oils in preference to measuring the dimensions of the instrument. In a similar way calibration in terms of Saybolt Universal seconds was made. G. R. N.

545.727

1342. Analytical Fractionation of Hydrocarbon Gases. W. A. McMillan. *J.I.P.T.*, 1936, **22**, 616–645.—A comprehensive article dealing with the results of five years' work on the testing and proof of the absolute accuracy of methods and apparatus for the analytical fractionation of hydrocarbon gases by the use of synthetic gas mixtures of known composition. Seventeen references. G. R. N.

543.845

1343. Determination of Lead in Doctor Solution. E. W. Ellis. *Refiner*, 1936, **15**, 335–336.—A standard ammonium molybdate solution is prepared by dissolving 20 gms. of the A.R. salt in 500 ml. distilled water. The lead equivalentof this standard is determined volumetrically using A.R. lead chloride dissolved in ammonium acetate–acetic acid using tannic acid as an outside indicator. The standard solution is then diluted until the lead equivalent is 0·025 gm. PbO per litre. 25-ml. doctor solution are then diluted with 50–75 ml. water, and the caustic soda is just neutralized with 50% acetic acid. The solution is heated to boiling and titrated hot with the molybdate solution until a drop or two shows a distinct yellow colour with a drop of approximately 0·5% tannic acid solution on a porcelain plate. The volume of molybdate is directly the weight of litharge per litre in the doctor solution. Notes on the method are given. G. R. N.

545.727.1

1344. Organic Combustion Apparatus for Highly Volatile and Inflammable Liquids. J. H. Bruun and W. B. M. Faulconer. *I.E.C. Anal.*, 1936, **8**, 315–316.—In establishing the purity of low-boiling hydrocarbons such as propane the carbon–hydrogen ratio may conveniently supplement other criteria. The combustion apparatus used was identical in principle to that used by Reid, special precautions, such as a separate vaporizing tube, controlled rate of evaporation, etc., being taken to avoid explosions. Details are given. G. R. N.

545.81

1345. Colorimetric Hydrogen-Ion Kit. H. Bottomley. *Refiner*, 1936, **15**, 327.—An inexpensive p_H kit is described for use in the control of condenser water alkalinity and of ammonia additions to corrosive petroleum distillate streams. It consists of five buffer solutions and four indicators covering a p_H range of 4·4–10·0. The buffer solution plus indicator in measured quantities is transferred to a 1-oz. homeopathic vial which is sealed. The sample to be tested is matched against the colorimetric p_H standards so obtained. G. R. N.

621.315.615.2 : 545.37

1346. Determination of Acidity in Insulating Oil. R. N. Evans and J. E. Davenport. *I.E.C. Anal.*, 1936, **8**, 287–291.—A description is given of a potentiometric method for the titration of acids in oil in which the glass electrode in *n*-butyl alcohol is used. It is indicated that this solvent should contain a small amount (approx. 1% by wt.) of water. Factors relating to the titration procedure are dealt with experimentally. The effect of easily hydrolyzable substances on the shape of the titration curve and on the estimation of acidity in oils is discussed. Fifteen references. G. R. N.

621.891.22

1347. Determination of the Coefficient of Friction. A. W. Burwell, J. A. Camelford. *Nat. Petr. News*, 12.8.36, **28** (33), 38.—Since a coefficient of kinetic friction is true only for the system on which it is determined, it is essential that all the variable factors should be under rigid control. The essential factors to be considered are enumerated. The authors' machine for the determination is described. It is of the type in which plugs are brought to bear, under a controllable load on a shaft rotating at constant speed. The results are expressed graphically in terms of one of the major variables. H. G.

621.892.097 : 536.421.4.08

1348. Photometric Determination of Iron in Used Engine Oils. A. R. Rescorla, E. M. Fry, and F. L. Carnahan. *I.E.C. Anal.*, 1936, **8**, 242–244.—According to several workers, wear in I.C. engines may be estimated from the iron content of the crankcase oil. About 10,000 miles of engine operation may cause a cylinder wear of 0·001 in. which can be actually measured, whilst the wear in 10 miles can be detected only by chemical means. The method described is applicable to the determination of iron in amounts from 0·00005 to 0·0015 gm., duplicate runs on each of 321 used oils showing an average difference of 3·8%. It consisted of carefully ashing a 10-gm. representative sample of the oil in a quartz (or platinum) crucible. The ash was dissolved in 20 ml. concentrated HCl, the solution washed into a beaker and boiled for 10 minutes. It was then made up to 90 ml. with water, then 10 ml. *N*-ammonium sulphocyanide were added. The resultant solution was put in a glass cell, which was moved along a graduated scale in front of a photronic cell until the latter was giving 10 microamps. Reference to the calibration curve of the photronic cell gave the iron content of the sample. A graph is given of the iron content against hours of operation for two Dodge engines lubricated with the same oil. G. R. N.

665.061.3

1349. Approach towards the Limit of Extraction. C. W. Griffin and M. von Saaf. *I.E.C. Anal.*, 1936, **8**, 358–360.—The extraction formula given is

$$Xn = Xo\left[\frac{KW}{KW + L/n}\right]^n$$

where W = ml. of solution, Xo = gms. of solute, L = total ml. of extracting solvent, K = distribution ratio of the solute for the two solvents and Xn = gms. of solute remaining unextracted after the nth extraction. The limit of Xn/Xo as n approaches infinity was found to have the value $e^{-L/KW}$. Plotting n against Xn/Xo for the cases, extraction of boric acid from isoamyl alcohol with water, of iodine from water with carbon tetrachloride, and of iodine from ether with ethylene glycol gave very close agreement with the theoretical curve. G. R. N.

665.521.2 : 543.845

1350. Determination of Elementary Sulphur in Gasoline. C. Wirth III and J. R. Strong. *I.E.C. Anal.*, 1936, **8**, 344–346.—The following method is described. Add from a burette 3 ml. standard butyl mercaptan solution (0·5 molar in sulphur free cleaners' naphtha) to 147 ml. of the gasoline to be tested. Agitate thoroughly in a small separating funnel for 5 minutes with 20 ml. sodium plumbite solution (30° Bé). Allow to settle and drain the plumbite. Wash the oil by agitation with 50% by vol. of 20% sulphuric acid until all the black lead sulphide is dissolved and the oil is restored to approximately its original colour. Settle and separate the acid. Wash the oil by agitation with 50 ml. of a 10% solution of acidified cadmium chloride to remove H_2S. Drain off the cadmium chloride. Determine the mercaptan sulphur content on 100 ml. of the gasoline by agitating with an excess of silver nitrate solution and back-titrating with ammonium thiocyanate, using ferric alum as indicator. Expressing this value as gms. of sulphur in 100 ml. gasoline, them elementary sulphur content of 100 ml. original gasoline becomes :

$$\frac{\frac{1}{2} \times \text{mol. wt. of sulphur} \times (\text{gms. butyl mercaptan added} - \text{gms. mercaptan sulphur})}{\text{mol. wt. of butyl mercaptan}}$$

It was found that H_2S and disulphides had no effect on the determination, which is claimed to be rapid, accurate and to facilitate the testing and control of gasolines or copper strip corrosion during refinery sweetening operations. G. R. N.

665.521.3

1351. Tendency to Smoke Test for Refined Kerosine. J. B. Terry and E. Field. *I.E.C. Anal.*, 1936, **8**, 293–295.—The Davis factor lamp used during the past 10 years to measure the maximum height of a kerosine flame without smoking was modified to improve accuracy and reproducibility. The principal modification consisted of placing a flat-bottomed porcelain dish (3 in.) filled with broken ice above the flame. The lamp is placed in a closed cabinet during the test. An aluminium scale is aligned against the cylindrical glass chimney (7 in. high, 1 in. o.d.) with the zero adjustable to the top of the cylindrical wick carrier tube. The lamp is allowed to burn for 15 minutes with a low flame, after which it is turned up to such a point that a smoke-spot is formed on the bottom of the dish. The latter is moved aside, the flame is lowered 0·5 scale divisions, and the test is then repeated. This is continued until soot is no longer deposited, when the height of the flame is read off the scale. It is claimed that this method is rapid and accurate. A highly-refined kerosine will give a flame 3 in. or more in height, a well-refined kerosine a flame 2 in., and an inferior kerosine a flame less than 1 in. This lamp can be used as a control test in the acid treatment of kerosine. G. R. N.

665.521.72 : 543.851.5

1352. Saponification Numbers of Asphaltic Petroleum Residues. J. H. Bruun and L. W. Claffey. *I.E.C. Anal.*, 1936, **8**, 255–256.—Some of the difficulties attendant on determining the saponification numbers of black asphaltic residues were minimized by use of a pressure agitation method. The weighed residue was mixed with 1–2 parts white oil (S.U. viscosity 80–85 secs. at 130° F.) and 3–4 gms. of the mixture were

transferred to a pressure flask; 50–100 ml. 0·05*N*-anhydrous alcoholic KOH were then added and the flask was shaken in a suitable apparatus for 30–60 minutes at 100° C. At this temperature good contact of the two liquids was obtained. When cool, the saponified residue adhered to the walls of the flask and the alcoholic layer was poured off and titrated with 0·1*N*-hydrochloric acid, using phenolphthalein or alkaline blue as the indicator. Results of some determinations on petroleum residues and on some organic acids are given. G. R. N.

Gas.

621.565.56

1353. Carbon Dioxide Produced from Gas Wells used as Refrigerant. L. P. Stockman. *Oil & Gas J.*, 17.9.36, **35** (18), 48.—The manufacture of dry ice by the compression of the natural gas produced in the Niland Area is becoming an important factor in the extreme south of California. The gas produced is almost pure carbon dioxide, as there are no hydrocarbons present and practically no inert gas.

Before entering the dry ice plant the gas is cleansed, compressed to 400 lbs., and then liquified in eight stands of ammonia cooled condensers. It leaves the condensers at 5° F. below zero, and is then cooled to 40° below zero and introduced into the snow machine, where it is expanded. The snow is then compressed hydrostatically to 2000 lbs. per sq. inch and comes out of the presses at 109° below zero.

L. V. W. C.

66.074.3

1354. Natural Gas Conversion to Carbon Monoxide and Hydrogen. W. A. Karzhavin. *Ind. Eng. Chem.*, 1936, **28**, 1042.—The process of converting natural gas with steam to produce carbon monoxide and hydrogen is described, the experiments being carried out on a semi-works scale. The natural gas used contained 87·4% of methane (actual composition given) and sulphur compounds were present to the extent of 0·1 gm. per cubic metre. The catalyst employed was prepared by impregnating fire-clay brick with nickel nitrate. Preliminary experiments indicated that the small amount of sulphur in the natural gas did not appreciably affect the activity of the catalyst, accordingly no steps were taken to remove this sulphur. The following procedure was adopted for operating the plant. The mixture of natural gas and steam entered the low part of the reaction chamber and passed upwards, being heated by the hot regenerative packing and catalyst. The converted gas left the upper part of the reaction chamber at about 1100° C., and no attempt was made to recover the heat in it. The gas passed to a tubular water cooler. When the regenerative packing had cooled, the conversion process was interrupted and the chamber reheated by combustion of natural gas with 20–30% excess air, the flow of combustion products being downward. Experiments were first carried out without the use of a catalyst. When the catalyst was employed the methane content of the converted gas was on the average 0·8%. During the conversion 1·9 cubic metres of steam (1·5 kg.) were added to 1 cubic metre of the natural gas, and 3·3 cubic metres of converted gas were produced containing 64% of hydrogen, and 22% of carbon monoxide. The total consumption of natural gas per cubic metre of a pure nitrogen–hydrogen mixture was 0·44 cubic metre, taking into account the gas consumption both for the conversion and for the heating of the packing. One cubic metre of the reaction chamber volume can yield 24 cubic metres of converted gas per hour. During operation the methane content of the converted gas was low at the start when the reaction chamber was hot, and gradually increased as the conversion period was prolonged and the packing became cool. The conversion period should therefore be short (about 10 minutes) in order to obtain a converted gas low in methane. Operation of the experimental plant indicated that the nickel catalyst retained its activity under the working conditions employed, and could be used satisfactorily for a period of three months, the duration of the tests.

H. E. T.

665.591.4

1355. Construction and Operation of Natural Gasoline Plants. Part IV. R. L. Huntington. *Refiner*, 1936, **15**, 341–346.—This concludes the series and in the same general fashion discusses gas gathering systems—the lease lines, gas measurement, determination of line sizes, changing the lines to casing-head connections, problems

connected with vacuum operation, air infiltration, disposal of drip gasoline and freezing of gas lines. G. R. N.

669.094.2 : 665.511

1356. Reduction of Copper Oxide and Tin Dioxide with Natural Gas from Sarmasel. C. Candea and J. Kühn. *Petr. Zeit.*, 2.9.36, **32** (35), 11.—Experiments with copper oxide and tin dioxide are reported using as reducing agent natural gas from Sarmasel containing 98·6% of methane. The velocity of flow of the gas was 3 litres/hr. Reduction in the case of copper oxide, commenced at 400° C. and was complete at 720° C.; methane was apparently decomposed into carbon and hydrogen. With tin dioxide, reduction took place between 700 and 910° C., but tin appears to catalyze the reaction only slightly. The degree of reduction with tin is not dependent on the velocity of flow of the gas, as is the case with zinc oxide (cf. *Angew. Chem.*, 1933, **46**, 57–61). Results are tabulated and diagrams given sharing the relationship between reduction and temperature. W. S. E. C.

66.074.371: 608.3

1357. Patents on Gas. Gas Light and Coke Co. H. Hollings, R. H. Griffith and R. N. B. D. Bruce. E.P. 452,167, 18.8.36. Removal of sulphur compounds from gases, *e.g.*, coal gas, by treating the wash oil leaving the gas scrubber first with an alkali metal carbonate solution to remove carbon dioxide, and then with a solution containing 5% by wt. of caustic soda in aqueous methyl alcohol solution (70–98% of CH_3OH). The washed oil is then returned to the gas scrubber.

66.074.371 : 608.3

Studien und Verwertungsges. mit Beschränkter Haftung? E.P. 452,417, 21.8.36. Desulphurizing of gases containing CO and H_2 by treating with at least 10% of alkaline carbonates admixed with reactive oxides or hydroxides of iron at 150–300° C. W. S. E. C.

Crude Oil.

665.51 (764)

1358. Talco (N.E. Texas) Crude Analysis. Anon. *Petr. Eng.*, Aug. 1936, **7** (12), 62.—The U.S. Bureau of Mines publishes the results from an analysis of the crude from two wells (Carr Well No. 1 and King Hughes Well No. 1) in the new Talco field of Titus and Franklin counties, Texas. The oil is produced from the Paluxy sand of Lower Cretaceous age at depths of approximately 4200 ft. The analyses show the crude from the wells to be very similar and to be of the wax-bearing paraffin-intermediate base type. The S content and C residue are high for oils of this type.

Carr Well No. 1.

General Characteristics of Crude.

Specific Gravity	0·907
A.P.I. Gravity	24·5°
Sulphur	2·77% wt.
Viscosity:	
S.U. at 100° F. (seconds)	200
S.U. at 130° F. (seconds)	115
Pour Point	Below 5° F.

Approximate Composition.

(Based on distillation data, Bureau of Mines Hempel Method).

	Percentage.	Sp. Gr.	°A.P.I.	Viscosity.
Light gasoline	3·7	0·669	80·0	—
Total gasoline and naphtha	13·6	0·725	63·7	—
Kerosine distillate	12·9	0·812	42·8	—
Gas oil	7·9	0·862	32·7	—
Non-viscous lubricating distillate	10·5	0·871–0·897	31·0–26·3	50–100
Medium lubricating distillate	7·0	0·897–0·908	26·3–24·3	100–200
Viscous lubricating distillate	—	—	—	Above 200
Residuum	46·6	0·999	10·1	—
Distillation loss	1·5	—	—	—

H. G.

665.514

1359. Breaking Emulsions in Khaduizhi. G. Maksimovich. *Nov. Tekhn. Neft.*, 1936, **4** (5), 6.—Experiments were carried out with naphthenic acid soap, water glass, commercial soap, starch and tretolite. Tretolite containing sodium oleate (80%), phenol (10%) and water-glass (10%) yielded best results, its consumption amounting to 0·05% on the volume of the emulsion. Tretolite was successfully substituted with 2–3% of alkali sludge from kerosine. For. Petr. Techn.

665.514

1360. Breaking Kala Crude Oil Emulsions. Ponyatkov. *Nov. Tekhn. Neft.*, 1936, **4** (2), 3.—The crude oil containing up to 6·2% emulsified water was treated with cracked residues at 65–80° C., releasing up to 87% water in 12 hrs. and the entire water in 24 hrs., whilst at 40° C. up to 96% of the water was separated after settling for 36 hrs., and on a treatment with cracked residue a complete separation was obtained in 60 hrs. The process is applied on a commercial scale. For. Petr. Techn.

665.514

1361. Electrical Purification of Oil. G. Sadakiyo. *J. Fuel Soc. Japan*, 1936, **15** (167), 78–79.—The three different methods given are: (1) steam is blown into the oil when there is a great amount of emulsion; (2) powder is added when the oil is extremely contaminated; (3) fibrous material is used when there is a small amount of suspension. In the first case the oil is charged to a cylindrical metal container having a steam inlet pipe at the bottom and a bar suspended in the centre forming electrodes with the wall. The oil is externally heated to a moderate temperature and steam is blown in under the application of a high-tension electric current. Eddy currents are produced, the emulsion is coagulated and precipitated. In the second method the oil is charged with a small proportion of white clay, magnesia or titania, heated externally and mechanically stirred. An electric current causes coagulation and precipitation. It is necessary to select powders having a colloidal charge opposite to that of the colloid to be removed. In the third method emulsions move under the influence of electric power and adhere to fibrous materials such as cotton, floss silk or glass wool inserted between the electrodes. It is possible to operate continuously and effectively. The general characteristics and advantages of electrical purification are: (*a*) the required electric power is small and direct current of high voltage is used in every case, (*b*) there is no change in the oil, (*c*) the speed of purification is high and (*d*) the method is simple and the cost of operation is low. G. R. N.

665.515

1362. New Treating and Dehydrating Plant. N. Williams. *Oil & Gas J.*, 3.9.36, **34** (16), 29.—The problem of treating and dehydrating crude oil from the Luling field has been solved by the erection of a plant using a new heating process. The crude, which is heavy asphaltic in type, is accompanied by slightly brackish water in proportions frequently as high as 98% of water to 2% of oil. Chemical treatment was found useless, efficient heating being the only successful method. Neither heat exchange nor direct heating in boilers was found of any use. The system eventually designed consisted of a steam-operated preheater, in which the emulsion is heated to 175–190° F. and thence to a 100-H.P. 300-lb. working pressure boiler. The treated emulsion then passes to a battery of six electrical dehydration units of conventional type operating at 11,500 volts. The emulsion is first settled as much as possible in the field, and then pumped to two accumulating tanks before being passed to the treating system. C. L. G.

665.514

1363. Oil Treating Methods. D. H. Fortine. *Oil & Gas J.*, 30.7.36, **35** (11), 71.—The author presents some of the more recent developments in crude-oil dehydration practices with a short discussion on the technical subject of emulsion theories. L. V. W. C.

Refining and Refinery Plant.

66.046.2

1364. Economics of Heat Exchangers. W. L. Nelson. *Refiner*, 1936, **15**, 293–297.—After an algebraic discussion of the relevant factors of heat-exchanger design and defining the temperature difference as "approach," the author concludes that: (1) The use of a closer approach temperature between the outgoing hot medium and the incoming cold meduim than the approach temperature now being used is economically sound. In the past the approaches have ranged from 30° to 100° F., whereas it appears that approaches between 12° and 40° F. are usually justified. (2) The factors that most greatly affect the economic approach temperature are number of years during which the investment in equipment is depreciated, the cost of upkeep and repair and the ratio of the weights of the two fluids that are exchanging heat; although other factors such as cost of surface, transfer rate, value of heat and the difference in temperature of the two fluids are important under certain conditions. (3) For a given cost of repair and upkeep there is a limiting low value of heat below which it is not economical to practice heat exchange. (4) The saving in a given heat exchanger does not change greatly if the approach is not exactly the economical approach, and hence the use of the general curves of approach versus economic factors, is sufficiently accurate for most commercial refinery conditions. (5) A general equation can be used for any counter-current exchange system, even for other materials than oil, providing the quantity of cold fluid exceeds the quantity of hot fluid. G. R. N.

665.541

1365. Modernization Economics. F. L. Kallam. *Refiner*, 1936, **15**, 298–300.—The modernization of refinery plant is discussed, and it is indicated that it is difficult for the management to make the correct decision unless a clear picture of the effect of the change can be presented by the plant-operating personnel. There is a common error in looking for large plant losses and disregarding the smaller ones. In many cases elimination of the latter can be accomplished with much less cost, although, bulked together, they are greater than the large loss. It is not recommended to scrap everything that is old, but instead it is shown that old plants may often be modernized to efficient operation through relatively simple changes with the use of selected items of new equipment and rearrangement of the old. It is concluded that there is evidence in abundance to show that a plant built ten years ago is hopelessly out of date when compared with a modern unit. Some examples are given of plant improvements showing both costs and savings effected. G. R. N.

665.545

1366. Crude Oil De-Salting Unit. Anon. *Refiner*, 1936, **15**, 322–323.—The Lion Oil Refining Co. process a heavy Arkansas crude which contains 180 gm. salt per brl. and which, unless removed, readily corrodes various parts of the distillation unit. This salt is crystalline, and the crystals are coated with asphaltic matter present in the crude. The salt content is reduced from 180 gm. to 3 gm. per brl. by intimately mixing the crude with water at 170° F. (100 : 20), so that the asphaltic skin is broken and the salt dissolved. The mixing is obtained by three devices: 2-in. orifices in a 6-in. line, then a centrifugal pump and finally a back-pressure regulator. The emulsion of crude oil and salt solution is broken by the application of an electric field in the usual way. The throughput of the unit is 2500 brls. per day. G. R. N.

669.14 : 620.192

1367. Effect of Hydrogen on Carbon Steel. E. Gavrun. *Nov. Neft.*, 1936, **3** (3), 4–6.—Decarbonization of steel plates in coking stills takes place through the action of hydrogen present in the flame (when burning oil with steam), as well as through the action of hydrogen separated as a result of cracking of the oil in the shell still. Hydrogen combines with carbon of the steel plates, leaving the latter as methane. The heating of steel in the medium of steam causes formation of scale at 925–980° C. It is concluded that high furnace temperatures (for stills or steam boilers) in the presence of hydrogen, steam and oil destroys the cementite of the steel, thus lowering its strength. The heating temperature should never exceed 720° C., and the velocity of combustion

products should not be higher than 1 m./sec., and moreover low-carbon-content steel should be used for boiler steel plates to assure a longer life of the equipment. Microphotographs are given. For. Petr. Techn.

Corrosion.

620.19

1368. Intensive Corrosion of Tube Stills. V. F. Negreev and M. S. Arutyunov. *Nov. Neft.*, 1936, **3** (4), 4–5.—The precipitates found in different sections of the tube still contained NaCl 93·02, $CaSO_4$ 0·94, $CaCl_2$ 0·36, $MgCl_2$ 0·39, H_2O 3·44 and mud, coke, etc. 1·22%. This precipitate, when taken up with water, showed an acidic reaction. The chemical analysis of condensed water yielded 0·1676 gm. ferrous iron and 0·1955 gm. chlorine per litre. A brownish precipitate found in the upper plate section of the bubble tower was composed of 27·39–28·94% ferrous iron, 0–1·52% sulphur and 30·4–33·0% chlorine. The bronze valves of the oil pumps were destroyed through the high content of active sulphur in the oil, forming a sediment containing 55·94% copper and 16·71% sulphur. H_2S separates during the distillation, and combines with Fe, forming FeS. HCl present in the vapours acts with FeS, forming FeCl and H_2O; the separated H_2S reacts again with a fresh surface of Fe, facilitating the formation of FeCl in the presence of HCl. These difficulties can be overcome by proper dehydration and treatment of the crude oil with NH_3, which should be admitted into the bubble tower.
For. Petr. Techn.

620.197

1369. Corrosion Behaviour of Painted Iron. *Paint Manufacture*, 1936, **6**, 281–283, 322–323.—A short account of a paper by R. M. Burns and H. E. Haring given at the 69th meeting of the Electro-Chemical Society, Cincinnati, Ohio.

The determination of the corrodibility of a metal or the efficiency of a protective coating by artificial ageing tests is costly and of no great value.

An electrochemical method was employed in which the change in potential with time of the metal was measured. It has been found that if the potential of the metal becomes more electropositive with time, the formation of a protective film and retardation or cessation of corrosion is taking place, and conversely if the potential becomes more negative.

The usual procedure for determining time–potential curves was followed, the potentiometer being replaced, however, by a vacuum tube electrometer when measurements on painted iron in other media of high electrical resistance were being made.

Details of the apparatus and procedure adopted are given. Two pigments were studied—red oxide (Fe_2O_3) and red lead (Pb_3O_4)—while raw linseed oil and a lead-cobalt dryer were used in the preparation of all the paints.

A series of time–potential curves is given for active and passive iron in water and dilute aqueous solutions, and for iron in paint pigments. Indications were obtained that red lead is superior to red oxide as a corrosion inhibitor.

Potential measurements on painted iron were made on submerged specimens, and time–potential curves are given for red oxide and red lead primers, curves for active and passive unpainted iron being added for reference.

Iron painted with red oxide primer was passive for about 20 minutes, after which water appeared to have penetrated the paint film in sufficient quantity to induce active corrosion. The curve is then similar to that of a linseed-oil-coated electrode. After several days the specimen was examined, and found to be corroded.

The addition of varnish to a red oxide primer increased the period of definite passivity about three times, but corrosion was obvious after several days' immersion.

The protective value of red oxide primers is dependent primarily on their ability to exclude moisture, and they must, therefore, be classed as physical inhibitors of corrosion.

Iron painted with red lead became definitely and permanently passive, and after several weeks' immersion showed no signs of corrosion. The behaviour of red lead indicates that it must be considered as a chemical inhibitor of corrosion. The reason for its passivating action is at present a disputed question.

Other applications of the time–potential method of investigation are suggested.
D. L. S.

620.197

1370. Anti-Corrosive Paints. (Conclusion.) E. Assheton. *Paint Manufacture*, 1936, **6**, 278–280.—The type of pigment used in a medium designed for the protection of iron and steel plays an important part. Thompson (*Proc. A.S.T.M.*, **7**, 493) gives details of a test, widely employed as a preliminary to determine whether any given pigment is rust-inhibitive or otherwise.

In a wide-mouthed 4-oz. bottle 30 gm. dry pigment and 2 oz. water are placed. Two weighed and brightly polished pieces of steel are immersed in the mixture, through which air is drawn continuously, and the metal is examined at intervals for the formation of rust.

The most popular pigment for anti-corrosive finishes is red lead sometimes admixed with white lead. Metallic powders (Pb, Zn, Al) have lately come into use, but have the disadvantage of settling out in a hard mass on storage. Blue lead, chromium compounds and graphite are also discussed as anti-corrosive agents.

There are practically only two media which are of use in compositions of this type—linseed oil and wood-oil–phenol formaldehyde resin varnishes.

The former, if of low acid value, plays no part, but the latter, owing to its water-repellent properties, is very valuable, although expensive.

Before applying the paint it is essential that the iron be dry and free from scale, grease and rust. D. L. S.

Cracking.

66.092

1371. Modern Cracking Process. G. Egloff and E. F. Nelson. *Oil & Gas J.*, 9.7.36, **35** (8), 43.—Owing to the high temperatures and pressures to which materials are subjected in a cracking operation, together with the corrosive nature of some charging stocks, special consideration has to be given to the materials that enter into the construction of this type of equipment. Requirements of refractories, steels and alloy steels for tubes, pressure vessels, condensing, cooling and heat-exchange equipment, receivers, separators, pumping equipment, piping and valves, insulating materials and control instruments are considered and recommendations made. Useful data regarding rates of corrosion of heating tubes using different cracking stocks are given, together with analyses and cost ratios of various kinds of cracking still tubes.

Tables show the increase in average compression of cars manufactured, consumption of gasoline compared with number of cars, and percentages of cracked and straight-run gasolines in total sales over periods covering the last ten years or so. The percentage of cracked gasoline has increased to 48·8% of total sales in 1935, due to the demand for higher octane rating. The effects which the increase in cracking has had on the gas and coal industries are considered. The large volumes of gaseous olefines made available from cracking plants have opened up great possibilities in manufacture of chemicals. Developments in this field are outlined. If the cracking process had not been developed, it is estimated that a billion brl. more of crude oil would have been required to operate the 26 million cars in the U.S.A. during 1935. R. A. E.

66.092.14

1372. Vapour Phase Cracking of Gas Oil. H. Otsuka. *J. Fuel Soc. Japan*, 1936, 15 (165), 59–66.—Two samples of gas oil were used, one paraffinic and containing no aromatics, whilst the second contained 25% aromatics. The cracking was carried out in a silica tube 100 cm. length and 2 cm. diam., acting as a vaporizer as well as a converter, and mounted in a vertical electric furnace. The range of cracking temperature investigated was 550–750° C. and the rate of flow was 4–5 gm. per minute while atmospheric pressure was employed. Tables are given for yields and analyses of the cracked distillates and cracked gases obtained. It is concluded that the conversion rates of the paraffin and naphthene components of the gas-oil samples are very similar for the range of temperature investigated, whilst the conversion rate for the aromatics is probably lower, *e.g.* 50% as against 97–98% for paraffins and naphthenes at 750° C. The yield of cracked gasoline increased at first with the cracking temperature to a certain maximum point, then gradually decreased. At the same time, the specific gravity increased with the temperature. The cracked gas was highly unsaturated, but the methane content was greater at the higher temperatures. The aromatics in the

cracked gasoline were synthesized from unsaturates under the experimental conditions employed, and not from the aromatics present in the original gas-oil. G. R. N.

Hydrogenation.

66.094.1 : 665.521.3

1373. Hydrogenation of Hydrocarbons. R. Fussteig. *Refiner*, 1936, **15**, 331–335.—Hydrogenation experiments on a cracked kerosine distillate containing 63% olefins and 7% aromatics are described and given in tabular form. It is shown that it is necessary to use a catalyst of large surface and relatively high pressure and temperature to accomplish complete hydrogenation of the olefins and partial hydrogenation of the aromatics. In the case of heavy petroleum oils it is preferable to use two-stage hydrogenation, liquid-phase followed by vapour-phase. Attention is directed to the use of methane as a source of hydrogen, and a process is outlined in which the oil is heated to 475–485° C. and is passed to a reaction chamber, where partial cracking occurs. The cracked products are then transferred to a reactor containing the catalyst, and contact with methane decomposed by heating to 720° C., hydrogenation and polymerization taking place. It is stated that a high yield of gasoline is obtained, the product being of high octane-rating, high volatility, low sulphur content, and predominantly composed of aromatics and olefins. G. R. N.

66.094.1 : 668.3

1374. Patents on Hydrogenation. H. E. Potts & International Hydrogenation Patents Co., Ltd. E.P. 452,429, 20.8.36. Hydrogenation of middle oils containing substantial quantities of phenols in order to obtain motor spirit. The oil is fractionated into two fractions, and the lighter fraction boiling to 275° C. is hydrogenated mildly to reduce the phenols. After separating any benzine formed, the fraction is hydrogenated so as to aromatize constituents at high temperature. The heavier fraction is then converted into benzine by a splitting destructive hydrogenation.

66.094.17 : 668.3

J. Y. Johnson. E.P. 452,158, 18.8.36. Hydrogenation of carbonaceous substances using as catalysts silicon compounds or substances containing silicon which have been previously activated with fluorine or hydrogen fluoride.

66.094.17 : 668.3

Comp. de Bethune. E.P. 452,821, 31.8.36. Improved furnace for the catalytic hydrogenation of coal, tars or oils.

66.094.1 : 668.3

V. Sauter and F. Klonnek. E.P. 452,860, 27.8.36. Hydrogenation of heavy oils for the production of light oil. The heavy oil is atomized into the reaction chamber, hydrogen is introduced, and the mixture in the chamber is then subjected to the action of a high-frequency induction field.

66.094.17 : 668.3

H. E. Potts. E.P. 452,917, 1.9.36. Hydrogenation of bituminous coal or coal-tar at 400–500° C. under high pressures in the presence of sulphides of metals of the sixth group of the periodic system and not less than 1% of an antidetonant, *e.g.* lead tetraethyl or iron carbonyl.

66.094.1 : 668.3

H. E. Potts. E.P. 453,419, 8.9.36. Hydrogenation of carbonaceous substances under 100 atm. pressure in the presence of hydrogen halides in an apparatus lined at points where the gases and vapours reach a temperature of 200–350° C. with an alloy containing at least 85% of silver (cf. E.P. 445,274). W. S. E. C.

Motor Fuels.

621.43–631.2 : 662.753.12 621.43–631.2 : 662.754

1375. Engine Performance with Gasoline and Alcohol. L. C. Lichtz and E. J. Ziurys. *Ind. Eng. Chem.*, 1936, **28**, 1094.—A report which deals with the power, fuel con-

sumption, and various other performance characteristics of internal-combustion engines, when using gasoline and ethyl alcohol as fuels. A preliminary theoretical analysis indicates ideal possibilities ranging from 2·0% increase in power with gasoline compared to pure alcohol, to 8·6% increase with pure alcohol compared to gasoline, depending on mixture conditions.

The water present in 190-proof ethyl alcohol has a negligible effect on power, but increases the specific fuel consumption by about 6·6%, owing to the lowering of the heating value for given quantity of fuel as compared with pure ethyl alcohol. Various tests carried out on a variable-compression single-cylinder C.F.R. engine and on a 1935 Chevrolet engine under various conditions indicate a small average increase in power, in favour of the 190-proof alcohol. However, the specific fuel consumption with 190-proof alcohol is approximately 60% higher on a weight basis, and about 50% higher on a volume basis than with gasoline.

Considerably large fuel orifices are required in carburettors for alcohol, and in addition higher compression ratios can be used with 190-proof alcohol than with ordinary gasoline, even when treated with 3 c.c. of tetraethyl lead per gallon. The advantage of higher compression ratios with alcohol is more than offset, both theoretically and practically, by the lower heating value of alcohol as compared with standard gasoline. H. E. T.

662.75 : 547.214

1376. Liquid Butane as Motor Fuel. M. M. Holm. *I.E.C. Anal.*, 1936, **8**, 299–300.—The use of liquid butane as a motor fuel requires special equipment, generally comprised of a pressure-regulating valve, a heater and a butane-metering valve. Corrosion and contamination of this equipment by the presence of deleterious material in the butane lead to unsatisfactory operation and eventually failure. To control the fuel in this aspect the following corrosion test was devised. An inverted cylinder (20 galls.) of butane was connected in series with a steam heater, a gauge glass in a slotted metal holder, a control valve and an orifice meter. Mirrors of copper or silver were prepared on glass strips by the usual methods and placed separately in the gauge glass. The fuel was passed over these mirrors at 10–50 lbs./hr. at 120° C. until 20 lbs. had been used. The mirrors were then examined, and showed an oily scum of non-volatile soluble material was present in the fuel, while traces of sulphur produced the usual blackening effect. The method was sensitive to minute traces of contaminants. G. R. N.

662.754 : 662.753.12

1377. Alcohol–Gasoline Blends. L. M. Christensen. *Ind. Eng. Chem.*, 1936, **28**, 1089.—A summary of the various types of alcohol fuels (alcohol–gasoline blends) with reference to their various properties and characteristics. H. E. T.

662.754 : 662.753.12

1378. Alcohol–Gasoline as Motor Fuel. G. Egloff and J. C. Morrell. *Ind. Eng. Chem.*, 1936, **28**, 1080.—An account is given of alcohol–gasoline fuels from various points of view, but principally from that of the ultimate consumer. It is concluded that such fuels have no great technical advantages over ordinary gasoline. The increased fuel consumption of a 10% alcohol–gasoline blend is approximately 4% higher than gasoline alone, based on both road and bench tests. The improvement in anti-knock value, and consequent efficiency when alcohol is added to gasoline, employing of course suitable design and operating conditions, is less than the decrease in efficiency as measured by fuel consumption. The over-all effect is therefore an increased fuel consumption. Further, the employment of alcohol–gasoline fuels introduces various operating difficulties, such as vapour locking, difficulty in starting and acceleration.

The handling, transportation and shipment of gasoline–alcohol fuels present difficulties, on account of the ease and rapidity with which the components of these blends separate on the addition of traces of water. Moreover, it is difficult to keep water out of storage tanks, filling-station tanks and motor-car tanks.

The cost of alcohol–gasoline is in addition higher than that of gasoline alone, and its use may have widespread detrimental effects on the social system. H. E. T.

662.754.1

1379. **Synthetic Methanol as a Fuel.** S. Kashima. *J. Fuel Soc. Japan*, 1936, **15** (165), 57–59.—After shortly describing tests with an aero engine and motor-cars using methanol alone and in admixture with benzole, it is concluded that it is possible to use methanol for gasoline engines if the fuel–air ratio is increased. The consumption of a 50/50 mixture of methanol and benzole is very similar to that of gasoline. Raw methanol and the purified product give equivalent results. Advantages of methanol are its high anti-knock value and low freezing point, whilst disadvantages are its high heat of vaporization and low calorific value. For the purpose of recovering its heat of vaporization, a preheating device for suction air and fuel–air mixture was attached to the exhaust pipe which is effective in utilizing the waste heat of the exhaust gas. Taking advantage of its low freezing point, circulation of a portion of the methanol in the radiator instead of water was also performed. By these modifications power output and fuel consumption were greatly improved. G. R. N.

662.754.1

1380. **Synthetic Fuels from Water Gas.** Anon. *Chem. Trade J.*, 1936, **99**, 190.—A memorandum published by the Utilization of Coal Committee of Mining Engineers gives a list of plants in Europe for production of methyl alcohol from CO and H_2. Fischer and Tropsch found that paraffinic oils could be produced from these two gases at atmospheric pressure at a temperature of 270° C. by the use of suitable catalysts. The theoretical yield of these products is about 1·4 gals. per 1000 cu. ft. of the mixture $2H_2 + CO$. Recently yields 70% of the theoretical have been obtained. This is equal to 35% of the calorific value of the coke used. The yield of motor spirit, known as Kogasin I, is 62% by wt. of the total oil products, but the octane number is low. Given the desired gas mixture, the success of the process depends mainly on the choice of catalyst and the maintenance of uniform temperature during the reaction. As a support for the catalyst, infusorial earth is commonly used, nickel–thorium, nickel–manganese–aluminium, or cobalt–thorium being precipitated thereon. The gases must be freed from sulphur compounds to avoid catalyst poisoning. Waxes formed during the reaction impregnate the catalyst and must be removed by solvents to avoid diminution in activity. Plants to produce a total of 85,000 t.p.a. of motor spirit by this process are under construction or planned. R. A. E.

662.754.2 : 662.753.12

1381. **Utilization of Ethanol–Gasoline Blends as Motor Fuels.** O. C. Bridgeman. *Ind. Eng. Chem.*, 1936, **28**, 1102.—This paper summarizes the technical information available on the comparative properties of gasoline and of alcohol blends from the point of view of their performance in actual service. The comparison of the two types of fuels is made on the basis of engine power, acceleration, fuel consumption, vapour lock, engine starting and warming, and water tolerance of the fuel. On such a basis for comparison the following conclusions were reached.

Blends containing ethyl alcohol have no great material advantage over gasoline as motor fuels, although if full advantage is taken of the technical information available, they may be used with satisfaction. From the standpoint of maximum power and acceleration, small percentages of ethyl alcohol in the blends are to be preferred to large percentages of alcohol; the same conclusions hold as regards, minimum fuel consumption, ease of engine starting and warming. The reverse conclusion is reached with regard to vapour lock and water tolerance. A compromise may, therefore, be necessary from the technical standpoint in determining the composition of the alcohol–gasoline blend most suitable for a given purpose.

Further, the alcohol used for blending purposes should be anhydrous, in order to prevent separation of the alcohol while in service; even so, it is difficult to prevent water getting into such blends and so causing separation. By employing a suitable blending agent, the water tolerance of the blend may be substantially increased, although the ethyl alcohol used must still be practically anhydrous, unless very large percentages of blending agent are employed. H. E. T.

665.531.2

1382. Refining Vapour-Phase Cracked Gasoline. E. Bart, Y. Gervart and R. Baidakova. *Nov. Neft.*, 1936, **3** (10), 7.—The unrefined and unstable gasoline was subjected to various temperature and pressure conditions, followed by a Lachmann treatment and redistillation of the obtained product. Best results were obtained in a treatment carried out at 250° C., pressure 15–75 atm., and a reaction time of 30 minutes, followed by a treatment with solid $ZnCl_2$ in the vapour phase and finally by redistillation with steam. For. Petr. Techn.

665.521.2 : 66.094.57

1383. Jets and Mixers Reduce Treating Cost. J. C. Albright. *Refiner*, 1936, **15**, 318–319.—At the plant of the Wilcox Oil and Gas Co. straight-run and cracked gasoline are separately treated with doctor. This was carried out in towers circulating the gasoline, and doctor with separate pumps. These treaters are now modernized, and only one pump (for gasoline) is used per tower, since a system of jets and mixers located outside near the base of the tower provides the requisite circulation and mixing. The amount of doctor solution required in both cases is also reduced by giving the gasoline an initial caustic wash, which, for the straight-run gasoline, is applied at the vapour condenser of the primary distillation unit. The doctor-treated cracked gasoline is finally gum inhibited. G. R. N.

665.531.2

1384. Refining of Cracked Distillates with High Sulphur Content. F. Sager. *J.I.P.T.*, 1936, **22**, 609–615.—An account of experiments on the refining of three cracked distillates with sulphuric acid at ordinary temperatures with centrifugal sludge separation, and the effect on their sulphur contents. G. R. N.

665.531.2 : 665.545.5

1385. Influence of Peroxides on Gum Formation in Cracked Gasolines. O. Pipik and E. Mezhebovskaya. *Oil & Gas J.*, 16.7.36, **25** (9), 50.—Two methods of approach were employed in a study of the connection between presence of peroxides in gasolines and formation of gums: (1) removal of peroxides already present in gasoline and comparison of velocity of auto-oxidation of product after removal of peroxides with that of original sample, (2) study of development of both peroxides and gums in various samples of untreated and treated gasolines. Methods used for removal of peroxides were: (1) filtration at room temperature through Florida earth followed by distillation with steam to remove polymerized products, (2) filtration through Florida earth in vapour phase, (3) bubbling gaseous SO_2 for 10–20 minutes through the sample, scrubbing with water and alkali, distilling with steam followed by distillation in a column, (4) refining with 5% solution of caustic soda, (5) refining with 5% solution of caustic soda and 2% solution of formaldehyde.

The gasolines examined were aged samples of vapour-phase cracked gasolines which already contained peroxides and gums. Where necessary the original product was distilled and/or treated with soda so as to give a fair comparison with the various types of refining treatment examined. The samples were exposed to light, peroxide and gum contents being determined at intervals. Peroxide content was determined by the KI method of Hyman and Wagner, and gum content by the porcelain cup test. Freshly-distilled gasoline contains no peroxides, but on exposure the untreated and earth-treated samples show formation of both peroxide and gums. The curve of peroxide content as a function of time is similar to that of gum formation, so that it may be assumed that gum formation is closely associated with peroxide concentration. In some other cases peroxide content decreases after a period of time and an increase in gum formation occurs. This is thought to be due to conversion of peroxides to gum. Of the five methods of treatment referred to above, No. 2 was most effective in inhibiting peroxide and gum formation, followed by No. 1 Gasoline treated by the other three methods gave greater rates of gum formation than the unrefined samples.

A sample of vapour-phase gasoline was then treated by three methods: (1) with Florida earth in the vapour phase, (2) acid and Florida earth in the vapour phase, (3) distillation followed by immediate addition of 0·1% hydroquinone. Portions of

the samples treated by methods (1) and (2) were also treated with hydroquinone. Results show that treatment with Florida earth removes peroxides and temporarily inhibits gum formation. After a certain period peroxides in the refined product begin to appear and to catalyze the formation of gums. When hydroquinone is also added, no gum is formed in 3 months. The gasoline was then fractionated into four cuts in order to trace development of gum and peroxide formation in the various fractions. All fractions showed gum formation on prolonged storage, but fractions 70–100° C. and 120–140° C. showed the highest rates. This observation merits further investigation. Treatment of the gasoline with 4% of 80% acid followed by 4% of 98% acid, scrubbing with water and alkali, and then fractionation into four cuts yielded products in which, whether earth treated and inhibited or not, the rate of peroxide and gum formation was considerably reduced as compared with the same gasoline not acid treated. Again there was no conformity to a law in the development of oxidation products by individual fractions.

When inhibitors are added, it is essential that this should be done immediately after distillation for best results. R. A. E.

662.753.1 : 608.3

1386. Patents on Motor Spirit. Wintershall A.-G. and H. Schmalfeldt. E.P. 453,546–453,547, 14.9.36. An apparatus and method are described for gasifying fine coal dust with a circulating gas chiefly for the production of water gas or gas for benzine synthesis. W. S. E. C.

621.315.615.2

1387. Insulating Oils. A. L. Read. *Min. Elect. Engineer*, 1936, **16**, 345–353.—After a general survey of petroleum technology, the significance of the physical and chemical properties of lubricating oils as regards their use as insulating oils is discussed. For cable oils and compounds the oil must be thin enough to saturate thoroughly at the impregnating temperature and thick enough at the working temperature to obviate drainage troubles. These oils should have a low coefficient of expansion, and low pour point, low specific inductive capacity, high d.c. resistivity, and low power factor over the working range. According to the author, British practice favours the addition of 25–30% of rosin to the oil. Special precautions must be taken to prevent oxidation of the oil, but in the finished cable the rate of oxidation is very small, as air and light are excluded. Rosin imparts a ∪ shape to the power-factor temperature curve. The power-factor/temperature characteristic rises with progressive ageing, due to the formation of less soluble rosin oxy-acids, whilst refined rosin greatly improves this characteristic. The viscosity for solid-type high-tension cables varies from 600 seconds at 140° F. for straight mineral oils to 1500–2700 seconds for the compounds. Other types of cable are briefly mentioned. Transformer oils are discussed on the lines of the B.S.S.148, this type of oil being used also for Switch-gear work and for impregnating the papers of condensers. C. C.

621.315 : 615.2

1388. Generation and Absorption of Gas in Insulating Oils under the Influence of an Electric Discharge. G. W. Nederbragt. *J. Inst. Electr. Eng.*, 1936, **79**, 282–290.—Measurements were made of the gas generated by mineral oils at 1 m.m. and 1 atm. pressure when subjected to an electric discharge. It was found that under reduced pressure, highly refined spindle oils show much greater gas generation than an aromatic Edeleanu extract, but in the latter case gas evolution is greatly increased by the addition of 10% gasoline, whilst for non-aromatic oils, the gas generation is greatly reduced by the addition of a low (0·5–5) percentage of more volatile aromatic (but not by an aromatic of the same volatility). The gas generated from *paraffinum liquidum* increases with increase of temperature, whilst for pure paraffin hydrocarbons it is greater the lower the b.p. Under 1 atm. of H_2, the pressure above a highly-refined spindle oil rose both at 20° and 60°, but more rapidly at 60°. A less-refined oil showed a fall in pressure at 20°, but a rise at 60°. With a highly-refined spindle oil containing 3% $C_{10}H_8$, the H_2 pressure fell when the discharge was applied both at 20° and 60°, but more quickly at 60°. Well-refined cable and switch oils, condenser and transformer oils which will generate little gas and yet retain their high resistance

to oxidation, high breakdown voltage and low loss angle, can be prepared by adding not more than 10% aromatic more volatile than the oil, *e.g.*, C_6H_6, $C_{10}H_8$, tetralin, α-methylnaphthalene, diphenyl, pyridine, quinoline, $PhNH_2$, etc. The most suitable substance to add and the best proportion differs with different oils. C. C.

Lubricants and Lubrication.

621.891.23

1389. Oiliness in Motor Oils. Part II. S. Kyropoulos. *Refiner*, 1936, **15**, 337–340.—This part is mainly devoted to the discussion of general physical properties such as polarizability and electric moment, valency angles and rigidity of molecules, etc. Substantiated by experiment there are three forces that determine molecular inter-action, viz. the dipole-alignment—or orientation effect, the induction effect and the dispersion effect. Their application to the liquid state and viscosity phenomena is generally outlined. G. R. N.

665.521.5

1390. Composition and Conductivity of Oils and Waxes. A. Gemant. *J.I.P.T.*, 1936, **22**, 646–662.—Experimental data on the conductivity–temperature relationship for a lubricating oil, a cable oil and a paraffin wax is given for the zone in which change of phase may take place. A theory is advanced for these phase systems and the approximate composition of these three materials is deduced. G. R. N.

665.521.5

1391. Trends in the Manufacture and Use of Lubricating Oils. O. Bell. *J.I.P.T.*, 1936, **22**, 663–664.—A précis of a paper read before the Rumanian Branch on modern trends in lubricating oil refining and utilization. G. R. N.

665.521.5 : 665.545.3

1392. Ketone–Benzole Dewaxing Process Employed by Gulf at Port Arthur. G. Weber. *Oil & Gas J.*, 16.7.36, **35** (9), 46.—By the use of methyl ethyl ketone and benzole favourable results have been obtained on 100% Penna grade stocks at Port Arthur Refinery, pour points of − 20 to − 25° F. being obtained. A mixture of 3 parts of 90% benzole and 2 parts of M.E.K. is used, and the proportion of solvent mixture to oil ranges from 3·5 to 4/1. The capacity of the plant is 925 brl. of Penna long residuum. A flow sheet of the process is given. Charges of wax, oil and solvent mixture delivered by recording flow controllers are pumped through a series of mixing heads, after which they are precooled by exchange with dewaxed mixture from the presses, and then lowered to the proper temperature in direct-expansion ammonia chillers. Four rotary filters, operating in approximately a 60-minute cycle, handle the chilled mixture. After filtering, excess dewaxing mixture in the filters is blown back, the slack wax on the leaves is washed with chilled solvent (in amount roughly equivalent to the volume of oil charged), which is charged to the dewaxed mixture flow tank, carrying with it the last of the wax-free oil. The cake is then dried by chilled flue gas under high pressure, and the wax is then removed from the leaves by back-pressure flue gas and carried to the flow tank by screw conveyor. The chilled flue gas is held in a high-pressure closed system including filters, and the various surge tanks. Filters are washed every three days with warm solvent mixture, which is pumped to the slack wax mixture tank. The evaporators comprise a series of square trays fitted with enclosed steam coils. Approximately 98% of the solvent mixture is removed as dry vapour from the dewaxed oil and slack wax mixtures in these units. All remaining solvent in the mixtures is removed in two identical strippers by superheated steam. The dewaxed oil passes to storage from one and wax from the other. Solvent vapours and water vapours are taken overhead, condensed and flow to the wet solvent accumulator. Overflow from this vessel consists largely of benzole which is decanted to the dry solvent receiver. The remaining M.E.K. and water are withdrawn from the bottom to a fractionator, heated at the base by exhaust steam. A constant boiling mixture of 90% ketone, 10% water, is obtained as an overhead distillate and is returned to the solvent cycle through an

accumulator. All heating is accomplished by steam to reduce fire hazard and avoid overheating of the lubricating stock. In obtaining a high yield of oil of low pour point, a spread of only 15–20° F. is required between actual chilling temperature and the pour point of the product.

Reduction of solvent losses in the gas-tight system and low initial cost of the ketone in comparison with that of other solvents contribute towards economic operation of the unit. R. A. E.

665.546

1393. Utilization of Acid Sludge. A. Voronov and Y. Kublo. *Nov. Neft.*, 1936, **3** (3), 1.—Acid sludge from lubricating oil refining, when treated with ethylene dichloride, permits the recovery of 25% of 72% acid (calculated on monohydrate). The Huber method permits the extraction of up to 70% of the acid, which is of greater strength, whilst the organic part is then a fuel oil, which does not separate a precipitate. The organic part of the sludge may be applied as a second-grade asphalt. The sulphonic acids which are separated together with resinous substances during NaOH neutralization can be used as emulsifiers for cutting oils. For. Petr. Techn.

621.892.2 : 668.3

1394. Patents on Lubricating Oil. Standard Oil Development Co. E.P. 451,3721, 5.8.36. Stabilization of polymerised oils and acids and esters obtained therefrom and of lubricating oils containing such polymers by adding a small quantity of sulphur, selenium or tellurium.

621.892.2 : 668.3

C. F. Prutton and A. K. Smith. E.P. 451,411, 29.7.36. Improved lubricant consisting of a major quantity of a lubricating oil base and a minor quantity of a chlorinated hydrocarbon, *e.g.*, chlorinated-phenyl-hexahydrobenzene or decahydronaphthene or pyridine or thiophen.

621.892.2 : 668.3

G. Leot. E.P. 451,730, 11.8.36. Deacidifying oils and fats by blowing an inert gas through the liquid while heavy particles coated with alkali or alkaline earth are passed through a sieve on to the oil surface.

665.521.5 : 665.543.061.5 : 668.3

Texaco Development Corpn. E.P. 451,881, 13.8.36. Solvent refining of lubricating oil using furfural.

621.892.2 : 668.3

J. K. Drysdale. E.P. 451,988, 14.8.36. A solidified oil is prepared from a mineral or vegetable oil by the addition of a dehydrated rosin-free soap containing not less than 70% of fatty acid. The mixture is heated to 295° F. and then allowed to cool.

665.521.5 : 665.543.061.5 : 668.3

Bataafsche Petr. Mij. and S. Tijmstra. E.P. 452,537, 25.8.36. Countercurrent solvent extraction of liquid mixtures using liquid SO_2, chlorex, phenol, etc.

665.521.5 : 66.067.55 : 668.3

Aktiebolaget. S-N. E.P. 452,778, 27.8.36. Improved centrifuge for use in the refining of mineral oils.

621.892.2 : 668.3

C. F. Prutton and A. K. Smith. E.P. 452,914 and E.P. 453,115, 31.8.36. Lubricant consisting of a major quantity of a lubricating oil base and a mixed quantity of a halogenated lubricating oil or kerosine.

621.892.2 : 668.3

C. F. Prutton and A. K. Smith. E.P. 453,047, 31.8.36. Lubricant consisting of a lubricating oil base and a halogenated naphthalene, anthracene, phenanthrene or homologues, or a halogenated non-oxygenated amino derivative of these compounds.

621.892.2 : 608.3

C. F. Prutton and A. K. Smith. E.P. 453,114, 31.8.36. Lubricant consisting of a lubricating oil base and 1.2.4-trichlorbenzene or a mixture of polychlorbenzenes.

665.521.5 : 665.543.3 : 608.3

Edeleanu Ges. E.P. 453,325, 9.9.36. Recovery of solvent in a dewaxing process. W. S. E. C.

Fuel Oil.

662.6

1395. Combustion Characteristics of Fuels. A. W. Trusty. *Refiner*, 1936, **15**, 309–312.—The transition in refinery use of fuel has been from solid to liquid to gaseous. In 1933 the total heat units generated were derived as follows, 54·7% from gas, 39% from oil and 6·3% from coal and coke. Fuel efficiency has increased. Thus in 1933 the average B.Th.U. consumed per brl. crude was 660,000, as against 840,000 in 1925. The combustion characteristics of fuels can be determined in suitable calorimeters, but it is possible to determine their heating value by use of formulæ involving chemical analysis and A.P.I. gravity; flame temperature can also be calculated from lower heating value and mean specific heat. Tables are given on the relevant characteristics of common gaseous fuels, the equivalent costs of domestic fuels in U.S.A., the ignition temperatures of common gases and the limits of inflammability of several gaseous paraffins. G. R. N.

662.613

1396. Flue Products of Industrial Fuels. J. S. Yeaw and L. Schnidman, *Ind. Eng. Chem.*, 1936, **28**, 999.—The purpose of this paper is to present charts, from which the dew-points of the flue products resulting from the combustion of industrial fuels with varying amounts of excess air, may be rapidly estimated.

A series of curves, based on the calculated dew-point data for the flue products of a number of industrial fuels (*e.g.* solid fuels, fuel oils and gaseous fuels of as widely varying compositions as could be found in the literature), are included on one chart. By means of this chart, theoretrical dew-point data, for the flue products of any ordinary industrial fuel with any quantity of excess air, can be estimated with an accuracy comparable to that to be expected in reading the chart itself, and of a sufficient order of accuracy for all practical purposes.

The theoretical quantity of air required for the complete combustion of the fuel, and the volume of flue products resulting, may be roughly calculated from the heat value of the fuel. From the limited amount of information available in vapour pressures of water–sulphuric acid solutions, a series of curves was constructed, showing the effect of sulphur trioxide on the dew-point for certain flue gas mixtures. Deviations in the dew-point data, arising from the presence of sulphur trioxide, must be recognized, since the theoretical dew-point alone is valueless from the practical standpoint. The catalytic effect of certain dusts and metallic salts in the flues on the oxidation of sulphur dioxide to sulphur trioxide is not taken into account in the recorded calculations, but must be kept in mind in the application of dew-point data in actual practice. The data supplied in this paper are of great use, on account of their direct bearing on the corrosion problem in industrial equipment. H. E. T.

662.753.31

1397. Utilization of Coal-Tar Oils in High-Speed Diesel Motors. K. Zinner. *Rev. Comb. Liq.*, 1936, **14**, 155–164.—The paper, which is the translation of an article published in the *Bulletin des Vereines Deutscher Ingenieure*, Nov. 1935, deals in detail with various work carried out to investigate the possibility of using coal-tar oils as fuels for diesel motors.

The problem is considered under two headings: (*a*) Modification of the injection method, (*b*) Shortening of the ignition delay.

The first is considered too costly and complicated to be of practical value. The possibilities under (*b*) are discussed in detail under the following: (1) Effect of chemical characteristics, (2) Hydromechanical means, (3) Increase of compression

ratio, (4) Provision of heat-storage zones at various points on the internal walls of the combustion chamber.

Various experiments dealing with the above are described and curves are given. The following conclusion is reached :—

The high temperatures which have to be reached in the combustion chamber of a diesel motor, when fuels of high ignition point are used, must be produced by methods which have no harmful effect on the combustion which follows. In the case of air-cell motors, a process has been worked out by means of which the air entering the air-cell is heated by an appliance functioning as a hot spot, this being fixed in the most advantageous position for heat exchange. The process has been tested out on three motors of entirely different construction.

By the special method worked out, normal combustion and running of high-speed air-cell diesel motors using coal-tar oils as fuels has been successfully achieved.

M. M. L.

662.753.325

1398. Handling Domestic Fuels. L. C. Trescott. *Refiner*, 1936, **15**, 324–326.—The demand for light domestic fuels in the rural districts of U.S.A. has increased rapidly in the last few years. The author stresses that the time has now come for the refiner to take the same care with the manufacture and handling of these products as is taken with the major refinery products. The care and maintenance of the loading rack, in particular, are discussed. It is suggested that for the present domestic fuels should conform to U.S. Govt. specifications for Nos. 1, 2, 3 and 4. G. R. N.

662.941.2

1399. Effect of the Characteristics of Fuel Oil on Burner Performance. E. N. Glendenning, W. A. Sullivan. *Nat. Petr. News*, 12.8.36, **28** (33), 41.—The smaller type of oil burner installation is dealt with. The carbon residue is shown to be of importance on burners of the vaporizing type. The modified Conradson test, which is carried out on the residue after distilling off 90% of the oil, is stated to be much more informative of behaviour in practice than the usual test carried out on the straight oil. Carbon residue is of much less importance when atomizing burners are used. High end-points in the distillation test are shown to be of little importance except in so far as a high end-point may indicate a high carbon residue. Viscosity is of importance, since it affects the degree of atomization, consumption, spray angle and, therefore, flame size and shape. Good burner nozzle design can, however, go far to overcome the disadvantages of change in viscosity. Sulphur, as a source of corrosion, is exonerated to a large extent, since, if operating conditions are correct, condensation cannot take place within the boiler or flues, and the formation of sulphuric acid is prevented.

H. G.

Asphalt and Bitumen.

625.85.063

1400. Asphalt Emulsions. J. W. Smith. *Refiner*, 1936, **15**, 306–308.—Plant for the manufacture of soap emulsified asphalts is described. Melted rosin and 30° Bé. caustic soda are separately passed through measuring-boxes into a steam-heated soap kettle fitted with a paddle agitator, the rosin being added slowly to the boiling caustic. After short cooking the soap is transferred to the water storage-tanks, kept at 120° F. to ensure ready solution. Positive displacement rotary pumps next pump the soap solution and asphalt in the required proportions to the dispersion mill, from which the emulsion is discharged to a cooler. A satisfactory mill is the heart of the plant. There are several types available which work efficiently, and are preferable to homogenizing valves or paddle mixers. A table is given showing the H.P. required to drive mills of various sizes.

With regard to the testing of asphalt emulsions, the value of the asphalt content, viscosity, stone coating and sieve tests is emphasized, whereas it is considered the settlement and water miscibility tests are of little practical use. It is finally noted that emulsification does not improve an asphalt, so that if an asphalt is unsatisfactory when used alone, it will be unsatisfactory when used as an emulsion. G. R. N.

Special Products.

547.21 : 66.094.3

1401. Vapour-Phase Oxidation of Hydrocarbons, source of Valuable Products. W. de Piotrowski and J. Winkler. *Oil & Gas J.*, 16.7.36, **25** (9), 58.—Catalytic oxidation of hydrocarbons in the vapour phase has been studied for six years at the refinery of "Galicja," Ltd., in Poland and the process patented. As starting material a hydrocarbon mixture of sp.gr. 0·77070·850 at 15° C. and boiling between 175–250° C. is used. It is preheated in heat exchangers to 150° C. and mixed with a measured quantity of air heated to 300° C. The hydrocarbon vapour–air mixture enters a reaction chamber containing a contact mass. The reaction is exothermic, the quantity of CO and CO_2 in the combustion gases being only 1–1·5% by vol. As accurate temperature control is essential, excess heat of reaction is removed. Gases leaving the chamber separate some resinous compounds. Fractions boiling above a determined temperature are removed in a column, and the vapours then pass through two coolers and an absorption tower, where all condensable fractions are collected. Uncondensed gas is used as fuel. Liquid and solid fractions obtained are redistilled and fractionated. The final products are: (*a*) fraction of sp. gr. about 0·790 and boiling range 50–150° C.; (*b*) fraction of sp. gr. about 0·840 and boiling range 100–200° C.; (*c*) fraction of sp. gr. about 0·890 and boiling range 150–250° C.; (*d*) a residue of solid resins of sp. gr. 1·1, softening point about 60° C. At least six simultaneous reactions are involved in the process, and no catalyst was found which would influence the reaction in such a way that only one definite type of product was formed. A catalyst permitting the lowest temperature of oxidation (260–300° C.), the highest yield of oxidized and dehydrogenated hydrocarbons and the smallest amounts of CO and CO_2 was therefore chosen. Varying the composition of starting material, rate of flow and reaction temperature influences the preponderance of oxidized or dehydrogenated products. The final products contain: (1) unsaturated hydrocarbons with one or two ethylene bounds, (2) aromatics, (3) saturated and unsaturated aliphatic aldehydes, (4) saturated and unsaturated ketones, (5) lactones, (6) alcohols, (7) small quantities of carbonic acids and phenols. The lightest and heaviest components contain the most oxygen and middle fractions the least.

Product (*a*) is sold as an odorizer for odourless gases under the name of Detektol O. Special, 0·2–0·3 gm. of odorizer in 1 cu. metre of gas permitting detection of traces of gas. An alcohol denaturant "Denoxol," which, in concentration of 1%, complies with stringent European regulation for such denaturants, is also prepared. Product (*c*) is suitable for prevention of deposition of solids in coal-gas lines. These deposits consist of naphthalene, resins, gums and rust and solvents such as tetraline, xylol, etc., dissolve only the naphthalene. Product (*c*), known as "Denoxol-Solve," inhibits formation of resins and gums from the unsaturated components of the gas, is a good solvent for preformed gums and resins and prevents rust formation owing to the film forming capacity which it has due to the presence of polar groups. It has been successfully applied in gas plants where gum and resin formation have given trouble.

R. A. E.

66.062.2

1402. Toxicity of Industrial Solvents. R. G. Harry. *Paint Manufacture*, 1936, **6**, 288–290.—A number of chlorine substituted hydrocarbons are first discussed. These have valuable characteristics which make them suitable for innumerable purposes and which can be summarized as: (*a*) high sp. gr.; (*b*) low inflammability; (*c*) low heat of vaporization resulting in extreme volatility.

Perchlorethylene is the least toxic of this series, and the relative toxicity of the other commercial products taking CCl_4 as 1, is perchlorethane 1·6, trichlorethylene 1·7, dichlorethylene 1·7, chloroform 2·2, pentachlorethane 6·2, tetrachlorethane 9·1.

A number of other solvents are discussed, including ketones, alcohols and esters. There appears to be little danger in the use of compounds of this type that are now employed commercially.

D. L. 8.

66.062.2

1403. Barnsdall Operating New Solvent Plant. D. H. Stormont, *Oil & Gas J.*, 13.8.36, **35** (13), 55.—A new plant of approximately 30,000 gal. per day intake for the manufacture of light hydrocarbon solvents has been recently completed in Oklahoma.

The equipment is of the conventional fractionating type, but automatic temperature and flow controls are used. The four towers each contain 30 trays, but vary in diameter from 16 in. to 36 in., and in operating pressure. The de-propanizing and special products columns are fitted with reflux pumps, but the debutanizing and de-ethanizing columns use natural reflux from overhead condensers. The charging material consists of raw natural gasoline from an absorption plant mixed with recompressor stock to a fixed specification in respect of gravity and vapour pressure. This has been found essential for smooth operation. Excess reflux from the de-propanizing column is passed to the de-ethanizing column, propane being removed at the bottom, whilst the overhead passes to residue lines for burning as fuel. Butane is taken as overhead from the debutanizing column, and the butane-free bottoms may be passed to storage as finished natural gasoline or used as feed stock for the special products column. In this column the desired cuts, such as pentanes and hexanes, are taken overhead, cooled and passed to storage. The control methods employed permit flexibility in operation and in quality of output. R. A. E.

667.7

1404. Insulating Varnishes. *Paint Manufacture*, 1936, **6**, 312–315.—Various types of insulating varnishes are discussed.

Bitumen varnishes can be regarded as "air drying," and they respond to low temperature baking treatments usually carried out at 95–100° C.

Their general characteristics are as follows: sp. gr. 0·879–0·928; volatile matter 34–54%; acid value 2·5–10·0 mgms. KOH/gm., ash 0·3–1% and drying time 1–100 hrs. at 95° C.

They possess good resistance to moisture penetration and are flexible, and from the electric strength aspect they are superior to clear oil insulating varnishes.

The application of the various varnishes and the testing of the insulating film are described. D. L. S.

547.572 : 668.3

1405. Patents on Special Products. J. Y. Johnson. E.P. 451,180, 30.7.36. Removal of phenols from waste aqueous liquors by treating them with a combustion gas which has been previously utilized for drying materials containing water.

661.763 : 668.3

J. Y. Johnson. E.P. 451,602, 10.8.36. An improved form of carbon black is prepared by treating carbon black with hydrogen at 350–500° C. and under at least 5–500 atm. pressure for 0·25–10 hrs.

547.279.3 : 668.3

I. G. Co. E.P. 452,215, 18.8.36 and E.P. 452,441, 21.8.36. Manufacture of high-molecular organic sulphur compounds.

547.678.3 : 668.3

I. G. Co. and O. T. Krefft. E.P. 452,656, 26.8.36. Manufacture of organic compounds containing fluorine, by allowing fluorine which is substantially free from oxygen and fluorine oxides to react in a reaction chamber which is sub-divided by means of inert solid substances.

547.261.2 : 668.3

Bataafsche Petr. Mij. E.P. 453,073, 4.9.36. Production of tertiary alcohols, *e.g.* butyl and amyl alcohol, by absorbing butane-butene or pentane-amylene in an aqueous liquid containing the butyl or pentyl ester of sulphuric acid.

547.313 : 668.3

Bataafsche Petr. Mij. E.P. 453,147, 7.9.36. Production of hydrated olefines using catalysts, *e.g.* Be, Mg, Zn, Cd, Al, Mn, Cr, Ce or Ni, in the presence of free H_2SO_4 under pressure in the presence of water. The process is carried out in a converter constructed of copper or copper alloy.

547.25.815 : 668.3

W. W. Triggs. E.P. 453,271, 1.9.36. Production of tetra-alkyl lead by allowing a small part only of alkyl chloride and a lead monosodium alloy to react until the

pressure falls against a rising temperature; the remainder of the alkyl chloride is then introduced rapidly into the reaction zone.

547.313 : 66.095.3 : 608.3

A. Carpmael. E.P. 453,422, 4.9.36. Manufacture of condensation products of mono-olefines by condensing them with aromatic compounds in the presence of addition compounds of boron fluoride containing at least one hydrogen atom capable of dissociation.

547.315 : 66.095.3 : 608.3

J. Y. Johnson. E.P. 453,431, 7.9.36. Manufacture of condensation products by condensing one molecular proportion of butadiene dioxide with two molecular proportions of aromatic and heterocyclic compounds which are free from sulphuric acid groups, but containing at least one group with more reactive hydrogen atoms—and coupling the substance with diazo-compounds.

632.951 : 608.3

A. Baláza. E.P. 453,364, 10.9.36. Insecticide comprising 20–30% of trichlorethylene and tetrachlorethane. W. S. E. C.

Coal and Shale.

622.337.2(411)

1406. Scottish Shale Products. Anon. *Chem. Trade J.*, 1936, **99**, 186.—The output of oil shale in Scotland in 1935 was 1,408,000 tons, and the production of crude oil and naphtha 30¼ million gals., reports the Secretary for Mines. There has been a considerable increase in the production of diesel oil at the expense of motor spirit and fuel oil, owing to increased duty on imported diesel oil for road vehicles. In connection with this development, the plant at Pumpherston has been modernized. About 25,000 tons of ammonium sulphate was produced, and progress has been made in the utilization of waste shale in the manufacture of bricks. R. A. E.

662.742(42)

1407. Low-Temperature Carbonization. Industry's Expanding Output. Anon. *Chem. Trade J.*, 1936, **99**, 190.—According to the Secretary of Mines' report for 1935, the quantity of coal distilled at low-temperature plants was 327,112 tons, an increase of 40,000 tons over 1934. Including three coke ovens operated at medium temperatures, there were 13 plants in operation. Tests were carried out with a fraction of the tar oils in diesel road vehicles. The R.A.F. continue to use low-temperature spirit, a mixture containing a large proportion of this fuel being consumed by 22 squadrons. Spirit obtained by low-temperature process was also placed on sale at filling stations, and early in 1936 over 100 pumps supplying this fuel were reported to be in operation. R. A. E.

Engines.

621.43–634.2

1408. Characteristic Curves for Heavy Fuel Aviation Motors. M. Précoul. *Rev. Comb. Liq.*, 1936, **15**, 191–195.—The work undertaken in various industrial countries to produce a heavy-oil aviation motor has given interesting results. A table is given showing the characteristics of five of the most up-to-date engines, of which the Junkers are already in use by the German air lines, whilst the Clerget, Bristol-Phœnix and Z.O.D. are about to be put into service. The following curves are shown and discussed: (*a*) indicator curve, (*b*) supercharging curve, (*c*) altitude, (*d*) a curve showing relationship between consumption and various types of fuel.

The curves given show the graphic methods employed in the study of diesel engines for aviation, and a table is appended giving in detail the processes studied by means of the above curves. M. M. L.

621.43–634.2 : 621.43.019.3

1409. Diesel Engine Combustion Research. A. F. Sanders. *D.E.W.A.*, S.131.—The author outlines what he considers to be the criteria for the successful design of com-

bustion chambers for high-speed diesel engines, and proceeds to consider to what degree the popular types at present in use attain these ideals. The direct injection and ante-chamber engines are first considered: both of these designs together with various other types of combustion chambers are shown incompletely to cover all of the basic features deemed conducive to the best performance. By giving special consideration to air flow in the design of the Fowler Sanders combustion chamber, the author has produced a design which he claims embodies all of the essential features laid down. Diagram showing the system of air flow employed are reproduced, together with a typical fuel consumption curve obtained from a small bore engine embodying this type of combustion chamber. It is shown that at optimum fuel consumption of 36 pint/B.H.P./hour has been achieved, whilst, owing to the high degree of intimate mixing of air and fuel obtained, it is claimed that 128 lb./sq. in. B.M.E.P. without smoke, or 132 lb./sq. in. B.M.E.P. with a small degree of smoke, has been attained.

E. F. C.

621.43.016

1410. Gaseous Explosions—Critical Initial Temperature for Maximum Rate of Pressure Rise. W. A. Pearl and G. G. Brown. *Ind. Eng. Chem.*, 1936, **28**, 1058.—Experiments are described, in which the rate of pressure rise, during the combustion of a variety of explosive mixtures, was measured. The apparatus consisted of a series of four bombs which covered a temperature range of from − 160° C. to + 220° C. Means were provided for indicating the pressure, and in the case of some of the bombs, the passage of the flame could be observed photographically through suitably located windows.

From the pressure measurements, the critical initial temperature which gave maximum rate of pressure rise, was determined.

The authors found that explosive mixtures giving products of combustion whose specific heats had low-temperature coefficients, had high critical initial temperatures; similarly the critical initial temperature was found to increase with the carbon–hydrogen ratio of the fuel. Increase of diluent, or excess oxygen or fuel, raised the critical initial temperature in all cases.

The critical initial temperature under conditions of constant initial pressure was found to be lower than at constant initial density for theoretical and near theoretical mixtures containing small concentrations of diluent nitrogen. For mixtures containing concentrations of diluent nitrogen equal to or greater than that of air, the critical initial temperature at constant initial pressure is higher than that at constant initial density.

Some confirmatory experiments, made on a gasoline engine, are also described.

J. G. W.

Economics and Statistics.

622.323

1411. Estimation of Probable Value of Wildcat Land. E. L. Ickes. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 1005–1018.—A method, based on the theory of probabilities, is given whereby the reasonable price or rent of undeveloped land may be calculated. As in all such problems, the method is the more accurate in its application the greater the number of cases considered. Its object is the estimation of the probable net profits per acre, and the value of the lease can then be based on that figure. Three cases are considered: leases on proven land, leases on an area where there is known to be a suitable structure but which is not yet tested, and leases on land where suitable structures are not known but are suspected to exist. A number of problems are worked out to illustrate the application of the method.

S. E. C.

622.323.351.82(82)

1412. Antecedents of Oil Legislation (Argentine). J. A. Celix. *Bol. Inform. Petroleras* (B.A.), July 1936, **13** (143), 53–68.—The discovery of oil at Comodoro Rivadavia in 1907 immediately attracted the big oil enterprises, and the National Executive, having no special oil legislation, had to rely on a comprehensive law regarding mineral fuels in general. Under the Lands Law No. 4167 the alienation of known oil deposits was prohibited, and the National Executive established reserve zones for official exploration.

The Mining Authority applied the decrees but they were strenuously fought, principally in Article 9 of the National Civil Code, which prohibits the State from exploiting mines.

The lack of technical oil knowledge made progressive development difficult in the Argentine without maintaining large reserves. The activities of the Y.P.F. are enumerated.

During nearly 30 years, some 30 law projects have been brought forward, and the question whether ownership of mineral deposits belonged to the National State or to the Province in which they were located was decided under Article 7 of the Mining Code, which assigned them to the State.

The oil legislation which has been passed allows development by private enterprise, by the Y.P.F., or by mixed organization, and definitely institutes State oil reserves. The law also includes provisions for the regulation of conditions, such as the maintenance of pressure in a producing stratum.

A Commission has been appointed to investigate petroleum imports in relation to internal industry and commerce, in order to protect national consumption.

B. F. N. M.

658.2 : 665.4/5(438)

1413. Motorization and the Problem of Oil in Poland. Anon. *Rev. Petr*, 3.10.36, (703), 1185–1186.—Poland's domestic consumption of petroleum products is almost insignificant, being only about one-twentieth of that of France, although her population amounts to 33 millions, and her constrained export of oil at prices, which are necessarily poor in comparison with the net cost of Polish oil, which is quite high, are the two established factors which are at the root of the decline of the Polish oil industry. Before the War Galicia occupied a high position as a producer of the world's oil requirements, but it now supplies only a little more than Germany, which is regarded as a country devoid of oil in commercial quantities. The Governments which have succeeded each other in the past decade, and whose chief anxiety was the increase of the country's military power—a vital consideration in view of Poland's geographical situation—have completely misconceived the important part played by oil in national defence. It is indubitable that the present production of 500,000 tonnes/annum could be increased considerably if the want of it was realized. Polish oil reserves are placed at 160,000,000 tonnes, probably the minimum figure, but it is unreasonable to ask Capital to enliven drilling, and thus increase production, if it has thereby merely to cater for a ruinous export. Rather the contrary procedure is more logically economic—namely, to debase the production so as to confine it to the demanded supply of internal consumption at a fixed price, and so to eliminate the losses due to an enforced export. At present a kilo of petrol sells in the country at a surplus equal to 0·27 zl or 0·82 fr., above the price obtained for an export kilo. Thus a second paradoxical conclusion arises—that, thanks to an oil policy ruinous to the nation's economical interests, the oil industry, in order to survive, should reduce its potential production by about 40% and confine itself strictly to the limit of domestic consumption. Actually, in view of the varied geological conditions, Polish oil cannot compete on the world's markets with either Russian or Roumanian, still less with American oil, a consideration which should dominate Polish oil policy. The only solution which would avoid the ruinous annihilation of the Polish oil industry is increase of domestic consumption, which, in short, means motorization of the country.

At present there are from 25,000 to 30,000 automobiles in Poland, or one vehicle for every 1200 inhabitants, a condition very prejudicial to the country's military power. A badly conceived transport policy by successive Governments has favoured the railway and the horse at the expense of the automobile. Public transport automobiles are subject to heavy licence fees, and private cars are considered by the Public Treasury as luxuries and the outward and visible signs of wealth. In these conditions, and leaving out of the question other factors such as bad roads, Poland would continue to be one of the least-mechanized countries of the world.

The author thinks this state of affairs may have aroused a lively reaction in military circles, following on the Italo-Abyssinian campaign, in which mechanical material and the victualling of fuels played a "primordial rôle," and that there is a now strong trend in favour of the automobile and oil. A Commission under the Presidency of M. Piasecki, Under-Secretary of State for Transports, has been formed. The first

effort is to enforce a lower price for automobiles, and an agreement has been made between a Polish firm and an American Motor Company whereby certain well-known cars are put on show at a very low price. The Government further proposes the reduction or remission of various taxes and certain financial readjustments. Motorization to be efficacious ought not to rely solely on private vehicles. It is essential that public road transports should be favoured, and concessions abandoned so that a return be made to a more liberal transport policy. Furthermore the problem of the motorization of the Army becomes more urgent. The recent visit of General Gamelin to General Rydz-Smigley, generalissimo of the Polish Army, and the conferences at which the motorization of the Army was thoroughly discussed, are very significant of the change which has begun to operate in this matter among the Polish authorities.

The article closes with a comparison of the Polish production for the first half of 1936 with that for the same period of 1935, showing that, on the whole, the progressive production decline, which has existed for several years, has been arrested, and that in some particulars a small increase has been registered. B. F. N. M.

658.2 : 665.4/5(47)

1414. Petroleum Industry in the U.S.S.R. The Influence of the Industry on the Mechanization of Agriculture. I. Ganitzki. *Mon. Pet. Roum.*, 1936, **37**, 1025–1027.—The article describes the position in regard to agricultural tractors up to October 1st, 1928, and the increase in development caused by the first five-year plan is outlined. Details are given of the reconstruction of factories for the production of tractors which occurred over the period 1933–36. At present the "C.T.Z." factories are producing 100 tractors a day. These tractors are 48–60 H.P., and have proved extremely useful in agricultural work. During the period 1928–36, the evolution of the tractor has been from the 10-H.P. wheeled vehicle to a 15–30 H.P., two-ton tractor, and then to the 10-ton 48–60 H.P. tractor. Finally a diesel-caterpillar type of 75 H.P. is in course of development, and it is anticipated that about 1000 of these will be in operation at the end of 1936. The development of the latter type has been influenced by the fact that the consumption of spirit for tractors alone had attained about 40% of the total spirit produced in the U.S.S.R. Hence some relief was necessary, and diesel-engined tractors were decided upon.

At the end of 1935 the total number of agricultural tractors in the U.S.S.R. was about 343,000, which figure will, it is estimated, be increased to 427,000 at the end of 1936. W. E. J. B.

658.2 : 665.4/5(47)

1415. Petroleum Industry in the U.S.S.R., Sakhalin Island and the Sakhalinneft. I. Ganitzki. *Mon. Petr. Roum.*, 1936, **37**, 1249–1251.—This article contains a map of the island which shows anticlines, oil-fields and the probable extensions of the fields. The east coat is open from June 15th to October 15th, but frozen for eight months. Petroleum was discovered at Okha (north of island) in 1880, but development did not occur till 1916–17. Farther south, the Baotasin field was prospected and ceded to a Japanese firm in 1918. In the spring of 1920 the Japanese occupied the northern part of the island and prospected all the east coast. Actual exploitation began in 1923, mainly at Okha, where 12,170 tonnes were extracted in 1924. A tectonic survey was completed by the Moscow geological committee, who took over work in 1925, whilst in December 1925 an agreement was reached with Japan covering eight fields (area of 5243 sq. km.). Each field is divided into squares of 27 to 42 hectares, which are allotted, chess-board fashion, to Russia and Japan. The richest oil horizons are in the lower Pliocene, where at Okha twelve horizons from 12 to 60 metres thick have been found. In the upper Pliocene oil is found only in the Nutovo and Baotasin fields. The oils found vary in gravity from 0·88 (middle Pliocene) to 0·94 (lower Pliocene). In 1926, 22 wells at Okha gave 28,300 tonnes, which had increased to about 155,000 tonnes in 1929.

The oil is delivered to tankers through submarine pipe-lines (4 in. and 8¼ in.) capable of handling 6000 tonnes a day. The Sakhalinneft produced from Okha 196,400 tonnes in 1933, which has increased to 236,000 tonnes in 1935.

Cracking plant was installed at Khabarovsk, about 1015 km. up the River Amur

(Siberia), and a refinery is under construction. The probable reserves of oil in Sakhalin were estimated in 1933 at 152,000,000 tonnes, but it is considered that this figure is low. A sample of crude from near the River Langhery (N.W. of island) gave gravity 0·901, Engler degrees at 50° C. = 1·35, gasoline 12·9%, kerosine 33·9%, lubricating oil 43·5%, residue 9·3%, paraffin content 0·17%, pour point below — 20° C.

W. E. J. B.

REVIEWS AND BOOKS RECEIVED.

Review.

55(72)

GEOLOGY OF THE TAMPICO REGION MEXICO. John M. Muir. Pp. xix, 280. 1936, American Association of Petroleum Geologists, Tulsa, Oklahoma; Thomas Murby & Co., London. $4.50.

WHEN one looks at the very full bibliography which Mr. John M. Muir gives at the end of his volume on "The Geology of the Tampico Region Mexico," one realizes how scattered the literature is and how little of it is in any way regional. The author has at last very ably given us a comprehensive and authoritative treatise dealing with the Tampico area as a whole. While he has naturally drawn freely on previous literature, a great deal of original work is incorporated, not only as regards compilation, but also as regards actual field work.

The volume is divided into four parts: (I) Introductory; (II) Stratigraphy and Palæogeography; (III) Igneous Rocks and Seepages; (IV) General Structural Features and Structure of Oil-fields; finishing with an appendix dealing with various miscellaneous subjects.

In the introductory part Mr. Muir gives a short history of the development of petroleum in Mexico, followed by a brief description of the Topography and Drainage.

The stratigraphical section, Part II, pp. 7–141, is dealt with very fully, and the author has wisely refrained from introducing more than passing references to oil in this section, devoting himself to the purely geological aspect. The section is well illustrated with photographs, sections and sketch-maps, and numerous lists of fossils from the various formations form a valuable feature. One has the feeling that the author probably regards this part as the real essence of his work. So detailed is it in places that future workers in this area will certainly regard it as the standard work of reference. Its very detail makes it perhaps more of a work of reference than an easily read general geological description of the area for those more or less unacquainted with this part of Mexico, but therein lies its great value: the author has given the knowledge to date for others to build on. Mr. Muir discusses the main productive limestone, showing that the old idea that it was the same as that exposed in Tamasopo Canon is erroneous, and that the productive limestone belongs to a lower horizon mainly Albian. He further shows that it falls into two well-marked facies: the Tamaulipas or bathyal facies met with in the Panuco fields, and the El Abra or reef facies of the "Golden Lane" or southern fields.

In Part III, pp. 143–157, a short description of the main igneous rocks is given, together with a classification of the main types of seepages.

Part IV, pp. 159–225, deals with structural problems and contains a description of the different oil-fields. After the very excellent stratigraphical section, the two pages in which the general structure of the northern and southern oil-fields is dealt with seem a little meagre. After the many theories which have been advanced to explain on structural grounds the vast concentrations of oil which have taken place, one rather hoped to have been given more detail under this heading: possibly the author is reserving this for some future occasion. We shall hope so.

The remainder of Part IV is a very good description of the different fields, with much valuable statistical matter incorporated in the text.

Mr. Muir adds an appendix in which, amongst other matter, he deals with oil-fields temperatures, "stripping wells" and acid treatment of wells.

The bibliography is very full and well set out. Enclosed with the volume are two structural profiles based on well logs, two structural maps and a general geological map.

The volume is completed by an excellent index. The author is to be heartily congratulated on the outcome of his prolonged work. JAMES ROMANES.

Books Received.

622.245.533

ACIDIZING HANDBOOK. Benson M. Kingston. Pp. viii + 78. 1936, Gulf Publishing Co., Houston, Texas. $1.50.

This treatise on the application of acid to oil wells covers the whole range of the subject. Starting from the chemistry and geology of treatment, the acid and its handling is discussed, and then the preparation of wells for treatment and the mechanics of treatment. Various aspects of acid treatment are dealt with, and the work concludes with a bibliography of 18 references and a series of useful relevant tables.

621.436.3

COMBUSTION-CHAMBER DESIGN FOR OIL ENGINES. Paul Belyavin. Pp. viii + 88. 1936, Constable & Co., Ltd., London. 3s. 6d.

Although the success of an oil engine depends largely on the design of its combustion chamber, very little is still known about its fundamental principles. Theoretical investigation is not possible, but an analysis of experiences and a study of the history of combustion-chamber design should help. These problems are critically surveyed by the author.

621.892 621.43.032

INSTITUTION OF AUTOMOBILE ENGINEERS. Vol. XXX, 1935–36. Pp. xx + 990; 45 pl.

Includes 21 papers read before the Institution during the period October 1935 to April 1936, together with reports of the discussions thereon. The majority of the papers relate to details of engines and to engine construction, but we note in particular "Lubricants—Some Recent Developments," by Prof. J. S. S. Brame (18 pp.) and "Carburation," by G. F. Gibson (29 pp.).

620.19

IRON AND STEEL INSTITUTE. FOURTH REPORT OF THE CORROSION COMMITTEE. Pp. xv + 240. 1936, The Iron & Steel Institute, 28, Victoria Street, S.W.1. 16s.

The results of the Committee's field tests on atmospheric corrosion of samples exposed for varying periods up to five years are now reviewed. Data regarding the analysis and preparation of the samples were contained in the Committee's 2nd and 3rd Reports (published in 1934 and 1935 respectively). The conclusions already reached by the Committee are summarized in the form of answers to specific questions of practical import. An account is also included of various laboratory researches on intermittent-spray testing, descaling, pickling inhibitors and other problems.

665.4/5(038)

PETROLEUM DICTIONARY FOR OFFICE, FIELD AND FACTORY. Hollis P. Porter. Pp. 253. 2nd Edn., 1936, Gulf Publishing Co, Houston, Texas. $3.00.

This dictionary is offered as a ready reference to all employed or interested in the petroleum industry. The field covered includes not only practical terms but technical words and terms used in the geological, chemical and engineering aspects of the industry.

ABSTRACTS.

	PAGE
Geology	524 A
Geophysics	529 A
Drilling	531 A
Production	533 A
Transport	536 A
Chemistry and Physics of Petroleum	538 A
Analysis and Testing	539 A
Gas	541 A
Crude Oil	542 A
Refining and Refinery Plant ...	542 A
Cracking	543 A
Hydrogenation and Polymerization	544 A
Motor Fuel	545 A
Lubricants and Wax	547 A
Fuel Oil	550 A
Asphalt	551 A
Special Products	551 A
Coal	553 A
Engines	553 A
Economics and Statistics ...	554 A
Reviews and Books Received ...	556 A

AUTHOR INDEX.

The numbers refer to the Abstract Number.

Albright, J. C., 1488, 1491
Atwell, H. V., 1492

Batcher, R. R., 1517, 1518
Baxter, J. P., 1515
Beck, H. V., 1481
Beitler, S. R., 1464
Belchetz, A., 1500
Bennett, H. T., 1505
Bennett, N., 1506
Bethlehem Steel Company, 1516
Bignell, L. G. E., 1450, 1459
Birkby, H. S., 1505
Blau, L. W., 1434
Boeringe, G. D., 1507
Boiling, E. H., 1484
Botset, H. G., 1431
Bottomley, H., 1495
Bowden, A. T., 1519
Boynton, A., 1442
Brack, J. D., 1442
Bredberg, L. E., 1455
Breese, J. J., 1507
Byrkit, G. D., 1503

Camp, J. F., 1436
Carnahan, F. L., 1469
Carpmael, A., 1494
Castleman, R. A., 1501
Candri, J. M., 1494
Clarke, L. A., 1505
Clough, K. H., 1419
Coberly, C. J., 1442
Cousens, F. R., 1444
Craxton, F. C., 1505
Crider, G. F., 1416
Culbertson, A., 1442
Curme, G. O., 1512

Dalrymple, D., 1429
Danchy, J. P., 1470
Davis, B. L., 1449
Day, R. B., 1500
Dearborn, R. J., 1505
Douglas, S. D., 1477, 1512
Du Pont de Nemours & Co., E. I., 1506

Edmister, W. C., 1471
Edwards, C. R., 1442
Edwards, T. O., 1505
Egloff, G., 1499
Eisenlohr, A., 1505

Eliel, L. T., 1417
Ellis, L. A., 1463
Erdheim, E., 1487

Farmer, J. O., 1435
Fenske, M. R., 1505
Finaton, C., 1422
Fletcher, H. W., 1442
Foster, L. P., 1500
Fuesting, R. S., 1504

Gamble, D. M., 1483
Ganitzki, L., 1521
Gemant, A., 1479
Gesell. für Linde's Eismaschinen A.-G., 1484
Ginsburg-Karagitschewa, T., 1424
Glassner, M. F., 1423
Gluesenkamp, E. W., 1510
Govers, F. X., 1505
Greensfelder, B. S., 1505
Greenstreet, C. J., 1516
Gruse, W. A., 1505
Gullette, W. S., 1490
Gutzwiller, A., 1509
Guyer, J. A., 1494

Harrell, D., 1462
Hass, H. B., 1510
Henny, V., 1492
Hinds, G. E., 1510
Hjerpe, E. B., 1505
Horner, W. L., 1420
Howes, R. T., 1496
Huntington, R. L., 1456, 1457, 1497

I.G. Farbenindustrie A.-G., 1493, 1505
Imperial Chemical Industries Ltd., 1505, 1506, 1515
International Hydrogenation Patents Co., 1493, 1505

Johnson, J. Y., 1484, 1493
Jones, L. D., 1505

Kay, W. B., 1474
Kerr, H. L., 1500
Kettering, L. C., 1505
Kimball, T. B., 1490
Knowles, E. C., 1505
Kraft, W. W., 1486
Krall, L. W., 1442
Kroenig, W., 1493

Lacey, W. N., 1472
Lane, A. A., 1442
Leavesley, A. S., 1505
Le Blanc, O. de, 1442
Lewis J. A., 1420
Lincoln, B. T., 1503
Lindeke, H. F., 1505

Mallishev, B., 1494
Manley, R. E., 1500, 1505
Mayes, C., 1458
McBee, E. T., 1510
McCluer, W. B., 1505
Meyer, W. H., 1418
Miller, G. W., 1492
Mills, B., 1426, 1446, 1447
Minshall, F. E., 1522
Montgomery, S. A., 1503
Morrell, J. C., 1492, 1494
Moser, F. R., 1500
Murphy, W. M., 1460
Muskat, M., 1448

Neely, G. L., 1480
Newsom, J. B., 1437
Nieuwland, J. A., 1470, 1473

O'Brien, J. W., 1440
Ockrent, C., 1506
Ocon, E. A., 1492
Octrocian Mast. "Activit," N.V., 1515

Pevere, E. F., 1505
Pier, M., 1492, 1493, 1505
Post, E. S., 1451

Raymond, E. P., 1442
Rescorla, A. B., 1469
Robertson, L. H., 1505
Rodionowa, K., 1424
Roess, L. C., 1476
Röhm & Haas Co., 1484
Rose, A., 1478
Ruhrchemie A.-G., 1484
Ruthruff, R. F., 1492

Sage, B. H., 1472
Sanders, T. P., 1425, 1428, 1454
Sawdon, W. A. 1432
Schemling, F. 1511
Sharples Specialty Company, 1516
Siebeneck, H., 1492
Simons, O. F., 1505

Small, J., 1520
Smith, L. E., 1483, 1483
Smith, L. R., 1439
Snoigr, D. S., 1445
Snow, H. R., 1505
Soday, F. J., 1513
South Metropolitan Gas Company, 1484
Standard Oil Development Company, 1505
Stark, D. D., 1505
Steiner, W. L., 1503
Stephenson, H. P., 1515
Stockman, L. P., 1435, 1466
Stoops, W. N., 1477
Studien und Verwertungsges. mit Beschränkter Haftung, 1484
Stueve, W. H., 1467
Swallow, J., 1516
Sylvania Industrial Corporation, 1506

Taylor, J., 1433
Taylor, J. W., 1442
Thomas, C. A., 1513
Thomas, H. D., 1430
Toby, E. M., 1514
Tschappat, L. P., 1442
Tucker, M., 1427, 1465

Ullrich, W., 1500

Valden, J. W., 1498
Villars, D. S., 1492
Vobech, A. O., 1500
Vogel, H., 1475
Vogt, R. R., 1473
Vose, R. S., 1505

Walt, J. F., 1492
Ward, J. J., 1506
Webster, D. C., 1473
Whitaker, C. N., 1496
White, H. C., 1442
Williams, N., 1441
Woods, G. M., 1502
Wyckoff, R. D., 1431
Wysznski, O. V., 1421

Yarborough, H. C., 1442
Young, C. A., 1473
Young, F. R., 1468

Zorichak, J. J., 1453
Zublin, E. W., 1492

Geology.

551.7(763)

1416. North Louisiana Stratigraphy Gradually Being Worked Out. G. F. Crider. *Oil & Gas J.*, 15.10.36, **35** (22), 74, 88, 90, 95, 96.—The oldest known producing formation in this region is at present termed Permian. It is certainly pre-Cretaceous, but further investigations may prove it to be Jurassic. The discovery was made at Snow Hill on the northern edge of the Smackover Field, the oil coming from a limestone at a depth of 4909 ft. Several of the fields in northern Louisiana plan to deepen their wells to test this horizon.

At the base of the Lower Cretaceous a series of marine shales with some limestone and sand was penetrated by a well at Pine Island, and this series continued to a depth of 6357 ft. A considerable amount of gas gave trouble as soon as the formation was entered, but it was eventually sealed off. This series gives signs of good oil production at Cotton Valley and Sugar Creek, and is expected to prove a prolific source of oil and gas in this region.

The Travis Peak formation comes next, and varies from a completely non-marine series at Pine Island, with a thickness of 2022 ft., to an entirely marine series at Caspiana of greater thickness than at Pine Island. At the latter locality the upper portion is mostly composed of brown to pink shales with occasional beds of sand and limestone, and is fossiliferous throughout. The lower part contains a pink anhydrite zone associated with siliceous limestone, shale and sand-beds; fossils are apparently completely absent. At Cotton Valley oil is found at the top of the Travis Peak, and several wells in other fields have given prolific gas production from the top of this formation.

Above the Travis Peak occurs the Lower Glen Rose, which is marine throughout, and has an average thickness of 1030 ft. It consists mainly of oolitic limestone with interbedded shales. The Upper Glen Rose is separated from it by an anhydrite bed varying from 300 to 600 ft. in thickness. A well in the Pine Island field produced oil from this anhydrite for a considerable time, but generally it is not considered as a probable source of oil elsewhere. The Upper Glen Rose consists of from 200 to 400 ft. of grey limestone with some sands and shales. It has not yet proved productive in this region.

The Paluxy, the uppermost member of the Cretaceous, is mainly red sand, shale, and limestone. At Talco in Texas a well is producing from near the top of the Paluxy, the oil being trapped against a fault-plane. This fault has been traced for some considerable distance, and a number of wild-cat wells have been drilled along it without further success. Showings of oil in this formation have also been reported from various areas in Northern Louisiana and Eastern Texas. J. A. G.

553.982

1417. Aerial Geologizing—Aerial Reconnaissance and Contour Mapping in Mining. L. T. Eliel. *A.I.M.M.E. Tech. Publ.*, 756, 1936, 4–20.—The author, while not professing to be an expert geologist, claims knowledge of general geology, especially on the evolution of aerial mapping for mining and oil problems, for which it can be divided into three general classifications: (1) Aerial Geology; (2) Detailed Geology; (3) Operations and development.

Under (1) would come the mapping of great tracts in Africa, Venezuela and the East Indies to select areas showing some evidence of geological interest.

Under (2) aerial mapping has been and is intensely used in the Western U.S.A.

Under (3) comes the value to oil and mining Companies of large-scale aerial maps throughout the world to assist in the office engineering, preceding actual construction operations.

The method used is governed by the nature of the country to be mapped and by the character of information sought. Had aerial mapping been developed at the beginning of this century such successful oilfield structures as Coalinga, Kettleman Hills and many other famous California fields would have been picked out by geologists at a glance, instead of taking years of patient prospecting on the ground. The special capacity of the aeroplane is given, together with its adjuncts and the requirements for the aviators. One great problem has been the navigation, since, with one exception,

pilots of the greatest experience and ability have been unable to fly strips from 60 to 120 miles long sufficiently parallel to each other without leaving gaps between the strips, at the same time maintaining an overlap of a reasonably limited figure. The Solar Navigator Device has been evolved to overcome this human disability. From this development has arisen a very improved method, devised to assemble accurately maps in a mosaic.

Photographs are taken at scales of 1 in. to 400 ft. up to 1 in. to 2000 ft. Using a lens of 12 in. focal length, an aeroplane, flying at 12,000 ft. will, ordinarily, make pictures of as much detail as the photograph taken by a 6-in. lens flying at 6000 ft.

Costs are given at per sq. mile of area, varying greatly according to the part of the world surveyed. The author concludes by comparing the advance made in aerial mapping in five years with the evolution in nature from the end of the Cretaceous period to the present day.

B. F. N. M.

553.982

1418. Aerial Geologizing—Development of Aerial Photographic Equipment. W. H. Meyer, Jr. *A.I.M.M.E. Tech. Publ.*, 756, 1936, 21–25.—During the past 17 years many improvements and changes have been made in aerial surveys and aerial photographic equipment. Aeroplanes for aerial photographic work are now specially designed. New cameras and equipment for every photographic aerial purpose are made. Various improvements are detailed. From single-lens type-models progress has been reached by way of three-, four-, and five-lens types to a large nine-lens type mounted on a single unit. Lens cones of different focal lengths have been developed.

Three paragraphs are devoted to photographic prints, and six aeroplane qualifications are set out. A list of some of the special instruments on the instrument board is given. The author ends with an account of some applications of Aerial Photography.

B. F. N. M.

553.982

1419. A Study of Permeability Measurements and their Application to the Oil Industry. K. H. Clough. *Oil Weekly*, 28.9.36, **83** (3), 33–34; 5.10.36, **83** (4), 27–34; 12.10.36, **83** (5), 54–58; 19.10.36, **83** (6), 46–54; 26.10.36, **83** (7), 42–50; 2.11.36, **83** (8), 39–44.—The data obtained from permeability measurements can be applied to production problems such as water-flooding, repressuring, estimation of reserves, rates of production, etc. The terms darcy, viscous, turbulent, effective and absolute porosity are defined, and the flow equations are derived for compressible and incompressible fluids. A test for viscous flow is outlined, and it is pointed out that small changes in atmospheric pressure and temperature such as occur in the average laboratory can normally be neglected.

Representative samples should be used, and the permeability should be measured along and perpendicular to the bedding planes. For preference, both measurements should be made on a single cubical specimen, although in the majority of cases the vertical permeability is not so important, but occasionally it exceeds the horizontal permeability. The specimen must be cut carefully to avoid blocking any pores, and contained liquids are best removed in a Soxhlet extractor, it being possible to measure the oil content in the same apparatus. Cylindrical specimens may be mounted in a rubber stopper, but for other shapes cementing with Wood's metal or sealing wax may be most satisfactory.

Air was used in the apparatus described, and the throughput was measured by calibrated orifice meters which could be used singly or in parallel. Using the calibration curves of the flow meters and working with specimens of a standard size, curves can be drawn connecting inlet pressure, outlet pressure and the permeability in millidarcys, thereby eliminating further computational work.

The apparatus can be used with uncemented and friable sands as well as with cemented specimens. A cementation factor can be derived by measuring the permeability of a cemented core before and after crushing. In this way a correction can be applied to friable specimens. Broadly speaking, the permeability increases with increase in porosity, but the sizes of the sand grains are an important factor.

G. D. H.

553.982

1420. Interstitial Water Saturation. J. A. Lewis and W. L. Horner. *Oil Weekly*, 19.10.36, **83** (6), 36.—The presence of water in oil reservoir cores has been observed, and the actual amount of water present is of importance in the estimation of oil reserves, as well as in determining the type of fluid which a particular stratum will produce under conditions favourable for flow into the well. The core analysis profile of a well cored with oil is compared with three other wells which were cored with water. Analysis of these cores points to the conclusion that water was distributed throughout the sand section with no indication of gravitational separation at the time of coring. Coring with oil or the addition of indicators to the fluid used during coring and the subsequent analysis of same are methods for determining correct interstitial water saturation. L. V. W. C.

553.982(438)

1421. Exploration Work in Poland. O. V. Wyszynski. *Petr. Z.*, 3.6.36, **32** (23), 31–34.—The "Pionier" Company was formed with the assistance of the large companies operating in Poland in order to carry out exploratory work. Its programme includes investigations of the problems of the Carpathian flysch folds, the deep Boryslaw folds, and the foreland. Systematic and exhaustive geological work has been carried out in the foreland zone, and in certain places pitting and core-boring have been necessary. To a large extent the work has centred on the problem of the tectonics of the E. Carpathian foreland zone. The stratigraphy of the foreland is not yet completely worked out, due to the lack of exposures, the lack of key horizons, and changes in facies. On account of this lack of exposures, geophysical methods, magnetic, gravimetric, and seismic, have been used. A number of wells were drilled during the years 1928–34. Amongst the more important were the following. Pionier 1 in Czarny-Potok, which was drilled on an anticline on the W. extension of Sloboda-Rungurska, and which, with the exception of good shows at 646 m., met only salt water horizons. The well Ignacy Boerner in Truskawiec, located to test the deeper salt formation, and which gave only gas shows. Pionier 1 in Rachin, located in the foreland anticlinorium, and which gave no result. Pionier 1 in Orow, which went to 2274 m. without reaching the Menilit shales of the Boryslaw fold. The well Minister Kwiatkowski, located to test the S. boundary of the Boryslaw structure, which has given production from a depth of 1699 m.

The result of this work has been to define the prospective producing territory, and the next step will be to initiate a programme of deep drilling. S. E. C.

553.982(443.8)

1422. Discovery of Petroliferous Jurassic and Triassic Horizons at Pechelbronn. C. Finaton. *Rev. Petr.*, 24.10.36 (706), 1573–1577.—A deep-drilling exploratory programme at Pechelbronn was encouraged by the knowledge of both Triassic and Jurassic of suitable facies on the edge of the Rhine Graben and by the discovery of oil in the Jurassic, near a fault on the edge of the Wintershouse Horst. Five deep tests have been put down. Heavy bitumen was found in fractured dolomites, whilst salt water under high pressure occurred in the Muschelkalk. Several shows of oil were also found in the Jurassic, and details of each discovery are given.

It is claimed that the results of drilling indicate that the Keuper may be productive in the south but not in the north. In the Muschelkalk, however, interesting discoveries have occurred in the north.

These discoveries are closely related to the recent developments at Bruchsal to the N.E. of Pechelbronn, where oil has been found in the Keuper.

The author concludes that there are two geological horizons in France with favourable lagoonal facies for oil formation—namely, the Middle and Upper Trias and the Oligo-Miocene, and the Rhine rift valley offers a favourable area for future developments. B. F. N. M.

553.982(479)

1423. Micropalæontology of the Caucasian Oilfields. M. F. Glaessner. *Petr. Z.*, 1.7.36, **32** (27), 5–12.—A short account is given first of the objects and the methods

used in micropalæontological work. The micropalæontology and the correlation of the Cretaceous and Tertiary horizons in the Caucasian oilfields are then described in some detail. A table is given in which the stratigraphy and character of the microfaunas in N. Caucasus and S.E. Caucasus are compared. Most horizons, from the Aptian to the Upper Pliocene, contain microfaunas, and in many cases these can be subdivided. In spite of local changes in facies, correlation between widely spaced fields can be carried out by micropalæontological methods and, in certain cases, also between the Caucasian and the Carpathian fields. S. E. C.

553.982(479)

1424. Biochemical Processes in Deep-sea Muds. T. Ginsburg-Karagitschewa and K. Rodionowa. *Petr. Z.*, 16.9.36, **32** (37), 1–5.—Investigations were undertaken to determine if there is a similarity between the bacteria found in the oil deposits of the Caucasus and those found in the Black Sea sediments. Samples were therefore taken at five points in the Black Sea and the bacteria examined. The soluble bituminous matter in these samples was as high as 10% of the total organic content, and its oxygen content was very low. It was found that there were various types of bacteria present: those which reduced sulphates and those which caused cellulose, fats and albumen to break down. Those bacteria which attack fats were isolated, and their action on fats and fatty acids was investigated. The chemical alteration was considerable, and was characterized by a reduction in the value of the iodine number and an increase in the content of unsaponifiable matter. The characteristics of these bacteria are very similar to those of the bacteria found in the N. Caucasian oil deposits, and a close relationship between the two may be presumed. S. E. C.

553.982(748)

1425. Secondary Fault Found Present in Pennsylvania Gas-field. T. P. Sanders. *Oil & Gas J.*, 8.10.36, **35** (21), 54.—The Farmington gas-field in Tioga Co., Pennsylvania, like most gas-fields in this region, is developed on an anticline which has a gentle dip to the north and a steeper southern flank terminating in a fault. A well recently drilled on the southern side of the fault has proved the presence of a secondary structural high parallel to the main fold. The crest of this smaller structure is about 300 ft. lower than that of the main fold, and is also faulted on its southern flank. It is possible that a third subsidiary fold may be found still farther to the south.

The field is situated on the Sabinsville anticline, which is one of a number of broad and gentle folds on the northern flank of the Appalachian geosyncline. The folding took place at the end of Palæozoic times, and is contemporary with the more intense movements which formed the Appalachian Mountains to the south-east. The faulting on the southern flanks of these anticlines is of the same age as the folding.

Production is from the Oriskany, which is here about 4285 ft. in depth. Wells are now being drilled to greater depths to test the possibility of oil and gas in sands below the Oriskany, which are productive elsewhere in the United States.

J. A. G.

553.982(76)

1426. The Gulf Coast as a Sleep Oil Reserve. B. Mills. *Oil Weekly*, 9.11.36, **83** (9), 46–50.—Forty-three of a hundred and two producing fields of the Texas–Louisiana Gulf Coast area have given over 10,000 brl./acre. Two have given over 250,000 brl./acre, and four others more than 100,000 brl./acre. In this geosynclinal area the Tertiary beds dip and thicken towards the coast, and hence the dip increases with depth. At depth beds may be present which are not seen 100 mls. from the coast. The deepest part of the geosyncline may be near the present coastline. The trough deepens eastward, the basement being perhaps 6000 ft. deep at Galveston and 15,000–18,000 ft. deep at the mouth of the Mississippi. Salt structures rise to various levels in this thick series, their tops being found in beds ranging from Eocene to Recent. Geophysics is searching for salt structures at increasingly great depths. No longer is production relatively shallow and from the flanks of domes, but now there are the deep, large, uniform producing areas of the non-piercement type of salt structure, such as may be the case at Conroe and Tomball. The Frio is the main objective

of those seeking production at about 8000 ft. on deep-seated structures, but the Cockfield, Upper Saline Bayou and Lower Saline Bayou are expected to produce oil on suitable structures.

This area seems favourable for deep drilling, and is probably unique in the large number and depth of the oil-bearing horizons. The costs of making discoveries will increase, but these may be offset by good production. G. D. H.

553.982(763)

1427. Potential Structures in North Louisiana. M. Tucker. *Oil & Gas J.*, 15.10.36, **35** (22), 66, 67, 100.—Following the discovery of oil at Rodessa, most of the wells drilled in this general area have, until recently, gone only as deep as the Glen Rose (Trinity). Recent tests, however, point to the possibility of a number of producing horizons below this formation, the structure of which will be similar to that of the upper beds.

So far only the upper portion of the marine Trinity Series has been penetrated. This leaves the lower portion of the latter series, the older Mesozoics and the Upper Palæozoics as potential reserves. At Cotton Valley four distinct producing sands were found below the Rodessa horizons, in the Travis Peak and lower marine Trinity. It is probable that the sand members of the Travis Peak do not persist throughout the whole of this region, but the possibility of shore-line conditions must not be overlooked.

The discovery of oil and gas on the north-western flank of Smackover in a limestone (which is generally referred to as Permian) is the only marker available for correlating these older beds. It is probable that future work may prove this limestone to be Jurassic and not Permian. It occurs at 4900 ft. at Smackover, but it is impossible to estimate the depth at which it might be found in northern Louisiana. J. A. G.

553.982(774)

1428. Two New Pools are Discovered in Central Michigan. T. P. Sanders. *Oil & Gas J.*, 5.11.36, **35** (25), 27, 35.—Wild-cat drilling has discovered two new pools in Isabella Co., Michigan. Production is thought to come from the Dundee at about 3918 ft., but it is known that there is an erosional unconformity between the Dundee and the overlying Bell Shales, and in some places the Dundee is entirely absent, the wells passing directly from the Bell Shales into the Monroe formation. The latter is a dolomitic limestone, and it is therefore possible that dolomitization has made the Monroe sufficiently porous to act as a reservoir rock.

Further wells are being drilled to test the area more completely, and until these have supplied additional information the details of the structures will not be known. J. A. G.

553.982(782)

1429. Nebraska Areas Bid for Place in Oil World on Five Wells. D. Dalrymple. *Oil & Gas J.*, 22.10.36, **35** (23), 23–24.—The major geological feature in this area is the Great Plains Basin. It is more or less continuous with the Central Nebraska Basin and the Salina Basin of Kansas. The eastern margin is the Nemaha Granite Ridge and Sioux quartzite area; the western limit is formed by the Cambridge Anticline, the Chadron Uplift and the Black Hills. It contains deposits ranging in age from Cambrian to Tertiary, and includes formations known to be productive elsewhere.

Geophysical work indicates the presence of 7800 ft. of sediments in some parts of the basin, and likely producing horizons include formations in the Cretaceous, Jurassic, Permian, Pennsylvanian, Mississippian and Cambrian. Several structures have been discovered near the western margin, and it is on these that some of the present test wells are being drilled. J. A. G.

553.982(787)

1430. Frontier–Niobrara Contact in Laramie Basin, Wyoming. H. D. Thomas. *Bull. Amer. Assoc. Petr. Geol.*, 1936, **20**, 1189–1197.—In the Laramie basin there are 700 ft. of shaly strata, which have been called the Frontier formation and which overlie the Mowry shale. At the top of the Frontier there is the Wall Creek sandstone. The Frontier formation is overlain by 250–300 ft. of grey, sandy shales, previously

termed the Carlile shale, and these in turn are overlain by the Niobrara. Palæontological considerations and correlation with the formations in the Great Plains show that the upper part of the Frontier formation of the Laramie basin is really Carlile in age, and that the so-called "Carlile" of the Laramie basin is really Niobrara in age. It is therefore suggested that the term Niobrara should be used to include the so-called "Carlile" of the Laramie basin, and that the use of the term "Carlile" should be discontinued in that area. Furthermore, it is suggested that this so-called "Carlile" shale is the equivalent of the Sage Breaks shale member of the Niobrara of the Black Hills area, and that therefore the term Sage Breaks might well be used in the Laramie basin. S. E. C.

622.276.2

1431. Flow of Gas/Liquid Mixture through Unconsolidated Sands. R. D. Wyckoff and H. G. Botset. *Physics*, Sept. 1936, **7**, 325–345.—D'Arcy's law is now firmly established, in so far as the viscous flow of homogeneous fluid through porous media is concerned, but the petroleum technologist has to deal very often with non-homogeneous fluids—mixtures of immiscible fluids, such as water–oil or gas–oil mixtures—and experiments show that the simple statement of D'Arcy's law does not describe the dynamical behaviour of the system, but further extensions of this basic law are required for analytical study of such systems. In a flow of mixtures the difficulty is the fact that the apparent permeability of the medium to either component is a variable, dependent in a complex manner on the relative concentration of the two fluid components present in the porous medium. The cause of the variation in permeability lies in the recognition of the Jamin effect. A particular instance of this effect is detailed, and the paper continues with a description and discussion of experimental technique, explained by 15 figures and four tables.

The conclusions reached from the experiments described are:

(1) That under steady state conditions of flow of gas/liquid through unconsolidated sands, the liquid saturation of the sand is determined by the gas/liquid ratio, and for a given ratio is not appreciably different for large differences in the sand permeability.

(2) That for all gas/liquid ratios below a certain critical value, the steady state condition for a given sand is always reached at the same saturation and permeability, called equilibrium, since they apparently represent a definite characteristic of the sand.

(3) The equilibrium permeability and saturation of a sand may be predicted from a measurement of its specific permeability, and this equilibrium permeability determines the maximum recovery obtained from the sand. Moderate variations in liquid viscosity and surface tension appear to have negligible effect on the permeability saturation relation for a sand.

(4) Gas/Liquid ratios of the order of 20,000 cu. ft./brl. are required to obtain a liquid saturation as low as 30%—liquid recovery of 70%—a factor of major significance of a sand when considering efficiencies of secondary methods of oil recovery or natural recovery methods which depend on the sweeping action of gas traversing the sand, so-called gas-drive effects. It is evident that high efficiency in natural or in secondary recovery is attainable only by discarding the gas-drive principle in favour of the so-called repressuring or expanding gas-cap method. The latter method takes advantage of the natural conditions wherein the geometry of the sand beds results in natural closed traps or domes, in which free gas will tend to collect because of buoyancy. Continued accumulation of gas within such closed domes, or the expansion of the gas cap incident to decline in pressure, must result in the displacement of oil down the flanks of the structure, where it is recovered via wells penetrating only the flanks.

B. F. N. M.

Geophysics.

550.834

1432. New Geophysical Methods Provide Reliable Data for Structure Mapping. W. A. Sawdon. *Petr. Eng.*, Oct., 1936, **8** (1), 35.—This paper deals with a new seismic method called the Rieber Geo-Sonograph, for segregating the reflected waves to permit their proper identification. The assumption adopted by all seismograph methods is that elastic waves set up by an explosion near the earth's surface are reflected from subsurface strata and return to receiving stations, near the shot, at

which are placed geophones to record the wave train. The relative time of arrival of the wave train at different receptors determines its apparent angle of arrival from the earth, and the total time of travel its total distance travelled in the earth. Thus the accurate determination of the times of arrival of reflected waves at several receiving stations is the object of all seismograph methods. In many methods the wave train is recorded by means of an oscillograph giving a summation of the impulses picked up by a number of geophones at the receiving station. This summation gives a clear record when the reflected waves reach the geophones in a direction normal to the surface, but when they reach it at an angle the summation becomes very indefinite. These are illustrated in Fig. 3 by two diagrams. The latter might be corrected by placing the geophones in the earth on a line normal to reflection, which is obviously practically impossible, as the geophysical work would be unnecessary if this angle were already known. A specially designed apparatus that sums up the wave impulses, recording them in a clearly defined line, is then described and explained. This is an automatic optical analyser (Fig. 5), and it is shown (in Fig. 6) that by adjusting the apertures in the analyser the wave trains can be put in phase, and the same result obtained as was theoretically demanded for placing the geophones at an angle in the earth (Fig. 4).

However, one simple wave train reflected by a stratum is seldom found in practice. Fig. 7, a simple syncline, shows what happens when waves arrive from more than one direction, and Fig. 8 shows diffracted waves in the case of a faulted reflector. The simultaneous arrival of reflection waves from many directions, as in regions of sharp folding or of general unconformity, will result in masking many important waves, and sometimes in the identification of less important waves than the lost waves. A comparison of the condition of a number of waves travelling in the same medium is made with carrier waves in the ether, but the contrast is that the radio waves have different tunable frequencies, one of which may be selected by tuning out, but wave groups returning from the earth as reflections from an explosion have no material frequency difference, but do differ in direction. To cope with this difficulty a directionally sensitive receiving means has been incorporated in the analyser, whereby a trace of the summation of the wave impulses of variable densities on the film is made on the analyser for one direction in space, then the analyser automatically sets itself for a trace at another angle. For a satisfactory working result about 40 trips through the analyser are usually necessary for each record. The speed of operation is probably a little greater than that of other reflection methods. 10 figures and two photographs.

B. F. N. M.

550.834(763)

1433. Intensive Seismic Exploration in North Louisiana District. J. Taylor. *Oil & Gas J.*, 15.10.36, **35** (22), 79.—Intensive seismic exploration in northern Louisiana and southern Arkansas has been initiated as a result of an occurrence of oil there in the Lower Glen Rose formation of the Trinity groups. The area had been drilled extensively to shallow depths, relatively few wells having been carried below 3000 ft. The conditions for obtaining good reflections in this region vary widely, and several difficulties are experienced. If the subsurface conditions are recognized, they may lead to the discovery of fault closed structures and even to "shoreline" fields.

L. V. W. C.

1434. Geophysical Patents. 550.834 : 608.3

Seismic Prospecting. U.S.P. 2,055,476. L. W. Blau, 29.9.36. The main object of the invention consists in a method whereby differentiation between direct and reflected waves is made possible by cancellation of the horizontal components against the vertical components. The first claim is for a means of separately transforming the vertical and horizontal components of the waves into electrical currents, of adjusting the amplitude of the horizontal components against the vertical and of opposing the electric current of the horizontal components against the current of the vertical component, whereby the total current is greatly reduced for direct waves and the current for reflected waves is substantially unaffected. 10 claims.

550.834 : 608.3

Electrical Circuits for Seismic Prospecting. U.S.P. 2,055,477. L. W. Blau, 29.9.36. In reflection shooting seismology, it is essential that the first arrival of waves be recorded, because, if the time of the first arrival of the wave is not accurately recorded, the depth of the reflection layer will be wrongly calculated. The first cycle of a reflected or refracted wave is generally small, progressively increasing until the maximum amplitude is reached in the third cycle. It is very much more difficult to recognize and record accurately a wave of small amplitude than those of larger dimensions, therefore a principal object of this invention is to increase the ratio of the first cycle amplitude to the second cycle amplitude of electric pulsations of given amplitude. A means and method of attaining this and complementary objects are covered by this Patent. 11 claims. B. F. N. M.

Drilling.

622.24

1435. Pressure Controlled Completions are not Necessarily High Pressure Operations. J. O. Farmer. *Oil & Gas J.*, 15.10.36, **35** (22), 131.—Completing wells under pressure control does not necessarily require dangerously high working pressures on the surface connections. Wells in the Wilcox sand in the Crescent field, Oklahoma, have drilling-in surface pressures of less than 200 lb. per sq. in. The lowering of possibly high closed-in pressures to the low drilling-in pressures is carried out by pulling the well nearly wide open while drilling is taking place. Where well capacities are large, relatively high bottom-hole pressures, together with low surface pressures, can be maintained with little, if any, assistance from the pumps. With low capacities the high bottom-hole pressures may be maintained by increasing pump speed or by measuring the amount of gas introduced through the drill-pipe. L. V. W. C.

622.24

1436. Improved Logging, Testing and Completing a Feature of Deeper South Texas Drilling. J. F. Camp. *Oil Weekly*, 28.9.36, **83** (3), 36.—Complete revision of equipment and methods of drilling has taken place to keep pace with deeper drilling and more thorough exploration of the South Texas district. Small light rigs have been replaced in many cases by heavier equipment and depths have increased from 4500 to 7500 ft. Owing to the lenticular nature of the formations of the coastal zone, coring is necessary and new types of core devices have enabled these coring projects to be carried on at almost the same speed as straight drilling. Electric formation logging and gun perforating are both practised in this area. L. V. W. C.

662.241.5

1437. Five-Foot Diameter Cores by New Method of Sinking Shafts. J. B. Newsom. *Oil & Gas J.*, 24.9.36, **35** (19), 68.—A method of drilling mine shafts instead of the usual blasting and mucking has been tried out by the Idaho Maryland Mines Corporation. A circular shaft 5 ft. in diameter and 1125 ft. deep was bored at Grass Valley, California. The drill used on this job was lowered into the hole on cable, thus eliminating drill rods, and consisted of a cabin containing a motor, the driving mechanism and controls and a seat for the operator. Six jacks were supplied to the cabin to enable it to be fastened securely to the sides of the drill hole. The drive unit was a constant-speed 40-h.p. motor driving through a vertical splined shaft. The core-barrel was 15 ft. long, attached to the lower end of the splined shaft. A number of valuable points were discovered during the initial work, and these are outlined. L. V. W. C.

622.242

1438. Reclamation has Proved its Value. L. P. Stockman. *Oil & Gas J.*, 24.9.36, **35** (19), 147.—The reclamation division of the Standard Oil Co. of California has grown to be one of the major service units of the Company. Four plants are now employed in reclaiming material. Much of this material is repaired, cleaned, adjusted and accurately assembled, and made ready to go back into service. The material which is found to be unsuited for reclaiming is sold. L. V. W. C.

622.242.2

1439. Butane Engine Drilling. L. R. Smith. *Oil & Gas J.*, 8.10.36, **35** (21), 45.—A recent innovation in the petroleum industry is the use of butane as a fuel for operating drilling rigs. Butane is considered one of the best and most economical fuels obtainable for use in I.C. engines because it is used in the engine as a true gas, and hence gives a uniform distribution of fuel to all cylinders. No difficulties from wet fuel on the walls arise, and crank-case dilution is eliminated. The limits of inflammability are lower than those of other commercial fuels. L. V. W. C.

622.243.44

1440. North Louisiana Mud Problems Found in Deeper Well Drilling. J. W. O'Brien. *Oil & Gas J.*, 15.10.36, **35** (22), 86.—Several operators in the Rodessa Field have experienced stuck pipe while spudding in at the surface. As a precaution against loss of time operators are using several tons of bentonitic clay for spudding-in mud. The formation stands up well to the top of the anhydrite but after this 70–80% of the effectiveness of the colloidal matter is destroyed by this calcium salt. Specially treated mud clay, which was found to remain in suspension in the anhydrite-saturated mud has solved the problem. In addition almost 2% by weight of the mud consists of colloidal clay. The weight of the mud is maintained about 10·3 lb. per gallon by adding water. Mechanical mud screening is carried out. L. V. W. C.

622.248.35

1441. Cratering Well Subdued by Drilling Offset. N. Williams. *Oil & Gas J.*, 8.10.36, **35** (21), 41.—A wild-cat well near Silsbee was killed by pumping water into the sand through a relief well and to ensure that the water had completely killed it 500 sacks of cement were pumped into the sand. The depth of the crater was 6982 ft., whilst the bottom of the relief well, drilled from a surface location 836 ft. north, 70 degrees 17 minutes west was at a depth of 7059 ft. Deflecting was commenced at 2096 ft. and continued to 7027 ft. Ten whipstocks were landed with one deflecting tool, and a total of 60 single-shot runs were made. After a depth of 5919 ft. had been reached the course of the hole was controlled entirely by weight and speed. L. V. W. C.

622.276.4 : 608.3

1442. U.S. Patents. J. W. Taylor. U.S.P. 2,054,916, 22.9.36. Automatic control valve for fluid lift device.

622.276.4 : 608.3

A. Boynton. U.S.P. 2,054,924, 22.9.36. Pneumatic piston pump for oil wells.

622.24.051.59 : 608.3

E. F. Raymond. U.S.P. 2,055,018, 22.9.36. Straight pull automatic rotary jar.

622.276.4 : 608.3

A. A. Lane. U.S.P. 2,055,296, 22.9.36. Fluid pressure pump operated by ring gear and pinion.

622.24.053 : 608.3

A. A. Lane. U.S.P. 2,055,297, 22.9.36. Hydraulic brake.

622.245.2 : 608.3

H. C. Yarborough. U.S.P. 2,055,515, 29.9.36. Cleaning device for perforated pipe consisting of a pair of packers to engage the pipe with a hollow mandrel between the packers with an opening to communicate with the outside. A plunger forces the pressure fluid to the outside.

622.24.051.56 : 608.3

J. D. Brack. U.S.P. 2,055,648, 29.9.36. Core taking device.

622.24.051.59 : 608.3

C. R. Edwards. U.S.P. 2,055,683, 29.9.36. Rotary jar.

622.276.4 : 608.3

O. de Le Blanc. U.S.P. 2,056,076, 29.9.36. A load equalizer for deep well pumps.

622.276.4 : 608.3

C. J. Coberly. U.S.P. 2,056,418, 6.10.36. A method of installing a pumping means in a well comprising pressure tubing with a fluid-operated mechanism at the lower end.

622.242 : 608.3

L. W. Krall. U.S.P. 2,056,471, 6.10.36. A well-drilling unit consisting of a motor for rotating a shaft attached to which is a pump. The discharge from the pump is forced against the drilling bit, and anchor plates are provided and pivoted in such a manner that they fall by gravity against the walls to prevent rotation of the unit.

622.24.051.59 : 608.3

H. O. White. U.S.P. 2,056,496, 6.10.36. Drilling jar.

622.245.1 : 608.3

L. P. Tschappat. U.S.P. 2,056,543, 6.10.36. A safety tubing head.

622.276.4 : 608.3

A. Culbertson. U.S.P. 2,057,137, 13.10.36. A combination oil rig and pumping jack. This is a four-legged tower, one side open to take a walking beam.

622.276.4 : 608.3

H. W. Fletcher. U.S.P. 2,057,425, 13.10.36. A method of producing oil from low pressure wells by the use of a plunger lift device. L. V. W. C.

Production.

622.245.2

1443. Cleaning Screens. Anon. *Oil Weekly*, 5.10.36, **83** (4), 48.—Oil screens clogged with any extraneous material are now being cleaned in the well by shooting a piston through a gun of 1¼ in. bore filled with water. This method avoids the removal of the casing, a costly business. L. V. W. C.

622.245.8

1444. Releasing Air from Oil-Sands Should be Done when Abandoning. F. R. Cozzens. *Oil Weekly*, 19.10.36, **83** (6), 18.—A certain amount of the millions of cubic feet of air which are pushed into underground oil-sands is forced into channels and reservoirs which have become depleted of oil and gas. A chemical problem peculiarly its own is created as a result.

It is reported that, during the re-drilling programme now being carried out, when the bit penetrates the oil-sand it is not uncommon for the well to catch fire at the bottom. Sparks from the tools ignite the oil or gas and fed by the oxygen from the underground air pockets the wells are quickly ablaze. The duration of the fire depends on the amount of oxygen present. Explosives are used to extinguish these fires.

Another condition is the occurrence of dead petroleum which, as a result of the disappearance of gas, becomes thick and heavy, plastering the face of the sand and making frequent cleaning necessary.

The safe course always is to release the air from the sand as quickly as possible after the field is abandoned by allowing the casing to remain open for three months or longer. L. V. W. C.

622.248.36

1445, Silsbee Wild Well Extinguished. D. S. Sneigr. *Oil Weekly*, 12.10.36, **83** (5), 20.—A wild gasser near Silsbee in Hardin County, Texas, which had been burning for 59 days was successfully controlled by the drilling of a directional relief well.

Normal methods for extinguishing the fire had failed, and although the depth of the well and the distance of the relief well from the burning well were much greater than either of the three previous relief jobs the flow of oil and gas was stopped in about 28 days. L. V. W. C.

622.276

1446. Practices at Tepetate. B. Mills. *Oil Weekly*, 5.10.36, **83** (4), 19.—In an effort to overcome a number of problems peculiar to the area several interesting drilling and production practices have been applied. Completion technique, metering of oil under high pressure, and stabilization of the oil to prevent loss in transit are among the operations in a new type of field for south Louisiana. Casing practices are interesting as open hole is carried from 1550 ft. to about 7300 ft. In addition the perforated pipe of the combination producing string is run into the hole lined with cement and the perforations are not cleaned until the cementing job on the outside of this string is completed. By this means the perforations remain intact and free of cement. Well pressures are high the original bottom-hole pressure amounting to about 3700 lbs. High-pressure oil meters are used for measuring crude oil under direct well pressure. The oil must be stabilized before shipping from the field and stabilizing units, to remove the lighter fractions, are used. L. V. W. C.

622.276.4

1447. Producing Efficiency Increased by Improved Completion Practices. B. Mills. *Oil Weekly*, 19.10.36, **83** (6), 23.—Increased attention to the mechanics of completion programmes has resulted from the necessity for a low gas/oil ratio and the elimination of water that was formerly allowed to flow with the oil. Much trouble has been caused in several fields by high gas/oil ratios, but satisfactory results have been obtained by shutting off the top gas and producing only a limited part of the horizon. Various completion practices have been devised all of which allow only a portion of the productive horizon to produce so that water is not permitted in the production. L. V. W. C.

622.276.4

1448. Bottom-Hole Pressure used in Determining Well Capacity. M. Muskat. *Oil & Gas J.*, 15.10.36, **35** (22), 128; *Oil Weekly*, 12.10.36, **83** (5), 30.—This is a mathematical article in which an equation is derived to give the maximum pumping capacity of a well. L. V. W. C.

622.276.4

1449. Use of Flow Beans. E. L. Davis. *Oil & Gas J.*, 1.10.36, **35** (20), 42.—The bean is an orifice placed in the flow line from the well for the purpose of applying a back pressure on the flowing well. It exerts a resistance proportional to the square of the rate of flow of the oil–gas mixture being produced. Several reasons for beaning exist, but all depend on the back pressure. "Heading" can be reduced or eliminated by the use of beans. Gas–oil ratio can be improved by their use. L. V. W. C.

622.276.4

1450. Electrical Equipment installed to Pump Wells in Fitts Field. L. G. E. Bignell. *Oil & Gas J.*, 8.10.36, **35** (21), 55.—Modern methods are being used in the Fitts Pool, Oklahoma, and one operator is building an electric generating plant to be used later to furnish power to pump the numerous wells owned by him. Pressure control methods are used for completion, and a gas engine-driven compressor plant was erected to supply gas at 225 lb. for drilling purposes or at 800 lb. for well completion. The new electric generating unit will be placed alongside this control plant and will supply current at 4160 volts for distribution to all wells. The plant is being so designed as to permit the gas engines on the compressors to be converted so as to operate additional electric generators. L. V. W. C.

622.276.4

1451. Simple Walking-beam Type of Pump Jack. E. S. Post. *Oil Weekly*, 19.10.36 83 (6), 55.—A simple type of pump jack is being successfully used by operators in the shallow field of Von Ormy, Texas. These jacks are very simple in operation. They can be installed within a short time and only sills for foundation and levelling are required. L. V. W. C.

622.276.4

1452. Control of Water in Pumping Wells. J. J. Zorichak. *Oil Weekly*, 12.10.36, 83 (5), 39.—This paper consists of a summary and review of the factors entering into the control of water production in pumping fields. Only those fields in which hydrostatic energy is the principal expelling force and in which the reservoir is one intercommunicating system are considered. Methods of using the hydrostatic energy to best advantage are discussed. L. V. W. C.

622.276.4

1453. Water Flooding to Recover Oil. L. E. Smith. *Nat. Petr. News*, 21.10.36, 28 (43), 70–78.—The preliminaries to an active programme of water flooding must include careful drilling and coring to determine saturation, porosity and permeability factors. From these an estimate of oil content and probable recovery is made and a programme of flooding can be outlined. Range of recovery of flooding in the Bradford City area appears to be from 2000 to 7000 brls. per acre.

The first year of operation is required for drilling and building up a water head. It is assumed that 40% of recoverable oil is obtained in the second year, 30% in the third, 15% in the fourth, and correspondingly smaller percentages afterwards. The volume of oil recovered is only a fraction of the volume of input water, and its ratio is diminished in process of time by admixture with increased quantities of water as flooding proceeds, until finally the well becomes uneconomic. B. F. N. M.

622.276.4

1454. Equipment used in Bradford Field Example of Late Types. T. P. Sanders. *Oil & Gas J.*, 1.10.36, 35 (20), 30.—The present price of Pennsylvania Grade crude oil has favoured the installation of better equipment, and has brought about the development by water flooding of many more leases. The majority of wells in the Bradford field are pumped by rod lines from central powers, band wheel and geared powers being popular. These central powers are generally set so that their eccentrics lie parallel to the plane of the hillside allowing a reduction in friction.

Vertical triplex power pumps are most generally used to force the water into the sand. Duplex double-acting plunger pumps have been used as well as single-stage vertical centrifugal pumps. L. V. W. C.

622.276.4

1455. Water Flooding in Burkburnett Field is Applied with Success. L. E. Bredberg. *Oil & Gas J.*, 1.10.36, 35 (20), 44.—Water flooding of an old depleted oil-field has been successful in the Burkburnett field in North Central Texas. In order that a loss of pressure should not take place around the shoe of the 7-in. casing this string was cemented in the newly-drilled input wells. Four producing sands are being exploited on the Hardin lease. The project was started in a line drive, although there was no uniform spacing of the old wells. In order to find water for this experiment a small creek was dammed up, impounding about 100,000 brls. of surface water, and a 16-ft. water well was dug, furnishing 800 brls. of water per day. Treating and settling tanks are used to prepare the water to be pumped into the sands. L. V. W. C.

622.323

1456. Estimation of Oil and Gas Reserves. R. L. Huntington. *Oil & Gas J.*, 15.10.36, 35 (22), 124.—The actual quantity of fluids in a reservoir can be estimated by a material balance provided solubility–shrinkage and P-V-T data on the original

bottom-hole fluids of a reservoir are known, together with fairly accurate statistics in the production of oil and gas. Water encroachment and the presence of an original gas-cap should be considered, since, under certain reservoir conditions, these variables may affect the calculated results markedly. L. V. W. C.

622.323

1457. Estimation of Oil and Gas Reserves. R. L. Huntington. *Oil Weekly*, 12.10.36, **83** (5), 25.—Further applications of the method of determining the contents of a reservoir based on a material balance are given, together with the necessary precautions to be taken and the limitations of the accuracy of the calculations. The actual quantity of fluids in a reservoir can be estimated provided fairly accurate statistics on the production of oil and gas are available and solubility–shrinkage and P-V-T data on the original bottom-hole fluids are known. L. V. W. C.

Transport.

622.324.5 : 658.787.6

1458. Alignment Chart for Gas Measurements. C. Mayes. *Refiner*, 1936, **15**, 370-371.—In the measurement of natural gas it is common practice to express the flow in cu. ft. per hour or day referred to some specific reference or base condition of pressure and temperature. To assist the fields engineer in obtaining these figures more easily an alignment chart is given which is based on the formula $Q_h = C\sqrt{h_w p_f}$, where Q_h is the quantity rate of flow, in cu. ft. per hour or day at base conditions, C is the orifice flow constant, consisting of all the conversion factors to convert flowing conditions to base conditions, h_w is the differential pressure in inches of water and p_f is the static pressure in lbs./sq. in. absolute. G. R. N.

622.698

1459. River Valley Aerial Maps Aid in Placing Crossing. L. G. E. Bignell. *Oil & Gas J.*, 24.9.36, **35** (19), 150.—Aerial photography was used to determine the last site for the crossing of the Mississippi River. A stretch of the river valley 20 miles long by 6 miles wide was photographed, and the right of way was decided so that the line would approach the river by a direct route.

A new application of aerial photography was made by a Tulsa Company recently. In this case an old river crossing had to be re-located, and a new line laid across the river. Aerial photographs were taken, and the finished photographs were in the hands of the Company within 24 hours after the order was given. L. V. W. C.

622.698

1460. Simplified Method of Pipe-line Construction. W. M. Murphy. *Oil & Gas J.*, 24.9.36, **35** (19), 130.—The construction of welded pipe-lines, with the improvements in welding methods, approaches the simplicity of screw-line construction. Materials of higher strength, but of lighter weight, have been made possible by improvements in the quality of welding materials. Recent simplified methods of laying welded lines originated with the laying of thin-wall pipe, and the method has been termed "stovepiping." With stovepiping the operation of welding a line can be made to fit any rate of progress. Stovepiping incorporates in a line the advantages employing an alloy welding rod with a reducing acetylene flame and a back hand welding procedure. The process consumes less than one-fourth of the gases required in position ripple welding. L. V. W. C.

622.698

1461. Holiday Detector makes Positive Check on Pipe-line Coatings. Anon. *Petr. Eng.*, Oct. 1936, **8** (1), 40.—A description is given of an electrical device for detecting pin-holes in pipe-line coatings. It consists of two wooden handles each riveted to a half-circle metal ring fitted to a hinge. Welded to the ring sections is a brush of fine wires, which are long enough to drag along the surface of the coating when the ring encircles the pipe. The positive wire from a portable battery is connected to the metal ring,

the ground wire being connected to the pipe. The ring sections are placed around the pipe and closed by bringing the handles together and the whole is pulled along the pipe. A holiday in the coating established a complete electrical circuit which is used to operate a warning signal. C. L. G.

622.698

1462. Detection of Holidays in Pitch Enamel Coatings. D. Harrell. *Petr. Eng.*, Oct. 1936, **8** (1), 97.—The operation of cathodic protection units depends on their drawing enough current on such lines from holidays in the coating, but the amount of current required is directly proportional to the number of holidays, so that these should be as few as possible. A description is given of a holiday detector which consists of a small wooden box containing four No. 6 dry cells and two spark coils. Two detector rings are used, one for each coil, the rings being on a split frame which fastens around the pipe and is provided with four castors supporting the weight of the frame and keeping the frayed copper screening used to cover the surface at an even distance and even tension all round the pipe. The ring is pushed along the pipe, any holidays being detected by the spark jumping across to the pipe. Small dry batteries render the apparatus easily portable, but require renewing every 3000 ft. or so while in continuous operation. For long jobs, a generator fitted to a motor-car is preferable, this being also available for providing floodlights for night work, heating electric soldering irons and running electric motors, etc. C. L. G.

622.698

1463. Leak Reconditioning on Large Diameter Gas Lines. L. A. Ellis. *Petr. Eng.*, Sept. 1936, **7** (13), 50.—The general practice of gas transmission companies is to repair leaks by clamping over the spot a rubber disc. The clamps used are thus in electrical contact with the pipe on one side and insulated from it on the other side by the disc, resulting in electrolytic action between the metal of the clamp and the pipe. It was therefore decided to insulate and coat the clamp. The general use of pitch enamel for this purpose has the drawback of critical application temperature (380–400° F.), difficulty of detecting pinholes without a lengthy examination, long drying time, necessity for using two materials at coupling (coupling compound and coating material), expensive nature and emission of phenolic fumes.

Hot asphalt has the disadvantage of absorbing water, and cold grease of being saponified by alkali soils. By accident, however, it was found that a hot asphalt coat covered with grease provided an ideal protection, the grease filling up the "pores" of the bitumen and only surplus grease being removed by the soil. In laboratory tests no reduction in resistivity after six months' immersion in salt solution was found. Practical tests were therefore carried out using first an asphalt–naphtha–gasoline primer, which was later substituted by a creosote–asphalt primer, which required no drying time, owing to absorption of the volatiles in the primer by the hot asphalt coat within 18–24 hrs. After smearing with heavy grease (plain cup grease or rust inhibiting chromate grease paints) the coating is covered with Kraft paper. Very satisfactory results after two years' trial have been obtained, both in the ground and exposed to the atmosphere, the grease not drying out and the asphalt retaining its elasticity due to the sealing up in it of its volatile components. C. L. G.

622.698

1464. Reports on Tests of Electric Welds on 20-inch Pipe. S. R. Beitler. *Oil & Gas J.*, 24.9.36, **35** (19), 184.—The Ohio Fuel Gas Co. conducted a series of tests to determine the efficiency of arc-welded joints in pipe. The results showed that the joints exceeded the company's requirements by a considerable margin. Sections of the pipe were welded up and tested by hydraulic pressure until failure occurred. A study of the results of all the tests leads to the conclusions that the welds are stronger than the pipe in all cases, that there was no tendency of failure along the axis of the pipe and the stiffness of the weld is increased by the use of a chill ring for the electric arc weld. L. V. W. C.

622.698

1465. Reconditioning Technique has Improved in the Last Five Years.—M. Tucker. *Oil & Gas. J.*, 24.9.36, **35** (19), 101.—An outstanding pipe-line reconditioning project has been under way for five years in the Mid-Continent area and consisted of uncovering, raising, cleaning, etc., whilst the lines were in service and under full pressure. There have been no losses in revenue or refinery production. L. V. W. C.

622.698

1466. Operate Long California Line without Pump Stations. L. P. Stockman. *Oil & Gas. J.*, 24.9.36, **35** (19), 86.—A new 72-mile pipe-line has recently been put into operation in the Kettleman Hills district with a capacity of 18,000 brls. per day and without a single pump station of its own. A small pump is used to remove oil from the submarine pipe-line at Estero Bay. The normal delivery pressure of 800 lb. of the Kettleman North Dome Association is high enough to move oil over the dominating central point. L. V. W. C.

622.698 : 665.51 : 665.521.2

1467. Crude and Gasoline Pipe-line Engineering Problems. W. H. Stueve. *Oil & Gas J.*, 24.9.36, **35** (19), 88.—This article consists of a general survey of pipe-line construction dealing particularly with the economics of the subject. L. V. W. C.

622.698 : 665.521.2

1468. Design and Cost of Gasoline Pipe-lines. F. R. Young. *Oil & Gas J.*, 24.9.36, **35** (19), 84.—The article consists of a description of the method of designing pipe-lines explained fully by means of an example. Capital cost and daily operating cost are considered. L. V. W. C.

Chemistry and Physics of Petroleum.

53 : 534/545

1469. Viscosity–Temperature Characteristics of Animal and Vegetable Oils. A. R. Rescorla and F. L. Carnahan. *Ind. Eng. Chem.*, 1936, **28**, 1212.—For 30 of the more common animal and vegetable oils, the following analytical data are given: specific gravity, viscosities at 100° F. and 210° F., viscosity index, gravity index, viscosity gravity constant, refractive index, saponification number, and acid number. J. W. H.

546.12.3

1470. Reaction of Metal Halides with Acetylenic Grignard Reagents. J. P. Danehy and J. A. Nieuwland. *J.A.C.S.*, 1936, **58**, 1609–1610.—The treatment of a Grignard reagent, *e.g.* phenylmagnesium bromide, with a metal chloride, *e.g.* chromic chloride, yields diphenyl as follows: $2CrCl_3 + 2C_6H_5MgBr \rightarrow C_6H_5 - C_6H_5 + 2CrCl_2 + 2MgClBr$.

The present authors have applied this method to acetylenic compounds, *e.g.* phenylacetylene magnesium bromide and cupric bromide give a 72% yield of diphenyldiacetylene. In general, such acetylenic Grignard reagents react with cupric bromide, chloride and ferric chloride to yield diacetylenes predominantly and some 1-bromo-1-alkyne. Using silver bromide as the metal salt, the formation of silver butyl acetylide was obtained in 60% yield from butylacetylene magnesium bromide. This offers corroborative evidence that the first stage in reactions of this sort is the formation of an organometallic compound. If this is sufficiently unstable, decomposition ensues to give hydrocarbons as shown above. W. E. J. B.

547.211

1471. Thermodynamic Properties of Methane. W. C. Edmister. *Ind. Eng. Chem.*, 1936, **28**, 1112.—Specific heats at constant pressure, differences in specific heats, Joule–Thomson coefficients entropy and enthalpy are computed from the published data on the P-V-T relationships for methane, and the values of Cp at 1 atm. The computed data covers the range − 70 to 200° C., and 1 to 120 atmospheres. The

data are presented graphically and in tabular form, and may be used to calculate the additional properties of internal energy, Gibbs free energy and Helmholtz free energy.
P. D.

547.211

1472. Phase Equilibria in Hydrocarbon Systems. XVI. Solubility of Methane in Four Light Hydrocarbons. B. H. Sage, D. C. Webster and W. N. Lacey. *Ind. Eng. Chem.*, 1936, **28**, 1045.—The solubility of methane in *n*-pentane, *n*-hexane, *cyclo*hexane and benzene was measured over the temperature range 100–220° F., and pressure range up to 3000 lb. per sq. in. The specific volumes of the mixtures were determined, and the experimental data are shown in tabular form.
P. D.

Analysis and Testing.

547.314.2

1473. Reaction of Butylacetylene with Hydrogen Bromide. C. A. Young, R. R. Vogt and J. A. Nieuwland. *J.A.C.S.*, 1936, **58**, 1806–1808.—When hydrogen bromide is passed into butylacetylene containing an appreciable amount of peroxides there is formed a mixture of 1-bromo-1-hexene and 1 : 2-dibromohexane. When no peroxides are present, the reaction is slower and the products are mainly 2-bromo-1-hexene and 2 : 2-dibromohexane.
W. E. J. B.

547.912 : 531.75

1474. Density of Hydrocarbon Gases and Vapours at High Temperature and Pressure. W. B. Kay. *Ind. Eng. Chem.*, 1936, **28**, 1014.—The P-V-T relations of eleven hydrocarbon mixtures in the gaseous state were experimentally determined over a wide range of temperature and pressure. It is shown that the results, expressed as deviation from the gas laws, may be correlated with those for pure hydrocarbons (ethylene and iso-pentane) by means of the theorem of corresponding states if the correct "pseudo-critical temperature and pressure" is assigned to each mixture. A graph is given by means of which the pseudo-critical temperature and pressure may be estimated from the mean molecular weight of the mixture and the U.O.P. Characterization Factor.
P. D.

532.13

1475. Inter-conversion of Viscosity Units. H. Vogel. *Oel und Kohle*, 1936, **12**, 835–837.—In a general discussion of the relationship between absolute and commercial units, the author compares the accuracy of the I.P.T. and German conversion tables for viscosities at which Poiseuille's Law is not valid for the Saybolt, Redwood and Engler instruments.
P. G. H.

536.514

1476. Determination of Critical Temperature and Pressure of Petroleum Fractions by a Flow Method. L. C. Roess. *J.I.P.T.*, 1936, **22**, 665–705.—A comprehensive account of the development of a flow method of measuring the critical temperature and pressure of petroleum fractions up to 1000° F. and 600 lb./sq. in., respectively, together with the correlations obtained between these properties and other physical properties more readily determined.
G. R. N.

547.914

1477. Polymer Distribution in Vinyl Ester Resins. S. D. Douglas and W. N. Stoops. *Ind. Eng. Chem.*, 1936, **28**, 1152.—The physical properties of synthetic resins vary in a general way with the degree of polymerization, at least until they become highly polymerized. An attempt has been made to determine the polymer distribution in vinyl ester resins, by solvent extraction and examination of the fractions thus obtained.
H. E. T.

66.048.2

1478. Distillation Efficiency in 3-mm. and 6-mm. Fractionating Columns. A. Rose. *Ind. Eng. Chem.*, 1936, **28**, 1210.—The number of theoretical plates in 3-mm. and 6-mm. i.d. columns 30·3 cm. long, unpacked, and packed with spiral, helices and carding teeth, were determined using benzene–carbon tetrachloride mixture. The effects of vapour velocity and insulation of the columns were studied. High efficiencies (up to 17 plates in 30·3 cm.) can be obtained at low throughputs. The most satisfactory packing was wire helices. P. D.

621.315 : 615.2

1479. Rapid Measurement of the Oxidation of Insulating Oils in Air. A. Gemant. *Trans. Faraday Soc.*, 1936, **32**, 1628–1633.—This test depends on the absorption of air by the oil being examined, and it has the advantages of simplicity and quickness, it being possible to complete a test in about 2 hours.

A volume of oil is kept in a closed space at a high temperature and constant pressure, and the progressing oxidation is measured by means of a manometer indicating the steadily decreasing volume of the air above the oil. In order to obtain quick changes in the volume of the air, the latter is chosen to be of the same order as that of the oil in contact with it.

The apparatus consists of a glass bulb 200 ml. capacity, filled with 130 ml. of oil. It is immersed in an oil-bath electrically heated, and is connected to a manometer. The apparatus can be shaken if required.

The best results have been obtained by keeping the temperature constant and plotting curves of changes in gas volume with time.

The curves are given for four different oils at 155° and 145° C., a copper catalyst being present in all tests. In the tests at 155° C. the oils exhibit somewhat different characteristics. Two show initial rapid absorption which suddenly stops. The third at first shows rapid absorption, which is then replaced by a slower process, and then stops. The fourth exhibits only the first rapid absorption, which stops very soon and much below the other three.

It is concluded that the steeper the curve and the higher the ordinate reached, the higher is the quality of the oil. This is accounted for by the fact that the less stable the oil, the further oxidation proceeds, and the more likely is the formation of volatile low molecular weight end-products which counteract the decrease of the gas volume.

Repeating the test on the same sample of oil shows that in the case of a good oil the same type of curve is given, with the final height continually decreasing. The less stable oil, however, yields different curves at each repetition, and finally gives a curve on the negative side showing a predominance of gaseous oxidation products over the oxygen absorbed.

Finally, the rate of change of volume has been plotted against temperature for all four oils, and the reason for choosing a working temperature of 155° C. is thereby demonstrated. D. L. S.

621.892.099.21

1480. Extreme Pressure Lubricants Testing. G. L. Neely. *J.S.A.E.*, 1936, **39**, 293–296.—The author first of all points out the necessity for E.P. lubricants and indicates briefly their nature. He then proceeds to outline the *raison d'être* of the S.A.E. Sub-Committee on E.P. Lubricants, and quotes the conclusion of the U.S. Bureau of Standards in their preliminary work for this committee on eight different E.P. lubricants using four machines, the Almen, Timken, Floyd and General Motors. This conclusion was "that no one of the machines under any possible set of conditions would rate the lubricants in accordance with their true service values." Some results on tests carried out in the author's laboratory using an Almen, Timken and a small worm-gear machine are given to illustrate the complexity of the problem, and the effect of operating conditions such as, for instance, vibration, rate of loading, test surface, etc. It is emphasised that friction-reducing value should not be ignored in the testing of E.P. lubricants. The data required from a machine are on film strength, friction reducing value, wear, corroavity, and stability and life of lubricant for various metal combinations. A brief description of the new S.A.E. tester is given, and for it the advantage is claimed that, as both surfaces are in motion, a combination of

sliding and rolling friction may be achieved. It is stressed that a true solution of the problem can be achieved only by correlating the results on this machine with actual service tests, but it is believed that the problem will be simplified by the use of the new machine. J. L. T.

658.787.6

1481. Measurement of Viscous Fluids. H. V. Beck. *Refiner*, 1936, **15**, 366–368.—Experiments are briefly described which show that viscous fluids with Reynolds numbers above 1000 can be accurately measured by using a round-edged orifice, in place of the sharp square-edged orifice used in measuring gases and less viscous fluids. The coefficient of discharge for the round-edged orifice is substantially constant at 0·855. The investigation of this type of orifice is still proceeding. G. R. N.

665.521.5 : 545.81

1482. Colour Measurements on Lubricating Oils. H. Siebeneck. *Oel und Kohle*, 1936, **27**, 793–795.—A Leitz absolute colorimeter is used in order to compare the sample with a standard solution of known "extinction." The depth of the oil column is adjusted until both fields are of equal intensity. Light of a narrow range of wavelengths, obtained by the interposition of a filter, is used for the comparison. The result is expressed as an extinction value for the oil. The ratio of extinction values before and after refining is stated to be useful for refinery control purposes. P. G. H.

667.7 : 532.13

1483. Thixotropy in Paints—Influence on Packaging and Application Properties of Flat Wall Coatings. D. M. Gamble. *Ind. Eng. Chem.*, 1936, **28**, 1204.—The general plastometric and thixotropic properties of paints are discussed. A torsion pendulum of the simple Schevedoff type has been used to measure rigidity and thixotropic properties of a series of flat wall paints. Correlation is attempted between such properties as pigment settling tendencies, brushability, and levelling with thixotropic characteristics. H. C. R.

Gas.

66.074.371 : 608.3

1484. Patents on Gas. Röhm and Haas Co. E.P. 453,071, 22.9.36. Recovery of HCN from coke-oven or other gases containing H_2S.

662.754.1 : 608.3

Studien und Verwertungsges. mit Beschränkter Hafture. E.P. 453,973, 22.9.36. Production of synthetic benzine and lubricating oil from hydrogen and carbon oxides.

66.074.37 : 608.3

Gesell. für Linde's Eismaschenin A.G. E.P. 454,130, 24.9.36. Separation of gases, especially of air, by liquefaction and rectification.

66.074.371 : 608.3

S. Metr. Gas Co. and E. H. Boiling. E.P. 454,175, 25.9.36. Removal of H_2S from gases by means of hydrated ferric oxide containing a sulphide of copper, mercury or lead which is capable of forming a sulphide which is insoluble in water.

66.074.371 : 608.3

Ruhrchemie A.G. E.P. 454,368, 21.9.36. Purification of coke-oven gases by hydrogenation in the presence of oxides or sulphides of copper or nickel on oxides or silicates as carriers.

662.754.1 : 608.3

J. Y. Johnson. E.P. 454,389, 30.9.36. Catalytic conversion of CO and H_2 at high temperatures to produce anti-knock fuel. Only those hydrocarbons boiling below 150° C. are polymerized.

662.754.1 : 668.3

J. Y. Johnson. E.P. 454,428, 29.9.36. An apparatus is described for use in reactions of CO and H_2 at high temperatures and pressures. The surface is coated by diffusion with an alloy of zinc or cadmium. W. S. E. C.

Crude Oil.

665.514

1485. Field Stabilization of Crude. L. E. Smith. *Nat. Petr. News*, 23.9.36, **28** (39), 30.—A new plant at the Tepetate field, Louisiana, is described. The plant embodies several novel features. The total production from the well is metered. All the crude is stabilized for the recovery of gas, which is then treated for gasoline recovery. After stabilization the crude is pumped by pipe-line to Lake Charles. Full operating data are given. H. G.

665.51 : 668.3

1486. Patents on Crude Oil. W. W. Kraft. U.S.P. 2,053,670, 8.9.36. Apparatus and method for the distillation of crude oil. W. S. E. C.

Refining and Refinery Plant.

66.067.72 : 661.183.44

1487. Bleaching Power of Some Bleaching Earths. E. Erdheim. *Petr. Zeit.*, 7.10.36, **32** (40), Motorenbetrieb, **9** (10), 9.—Several bleaching earths have been investigated—natural and activated earths, *e.g.* Terrana, Frankonit, Bentonit, Silitonit and Vegetalin. These were applied in varying quantities to bleach dark rape-seed oil, and finally linseed oil. The decolorizing values were determined for each earth (using the bleached oil) by means of a Lange–Roth photometer, which measured the absorption by means of a photo-electric cell. The values obtained were compared with Vegetalin as a standard. It was found that natural bleachers were weakest, Frankonit was comparable with Terrana and Silitonit SAH was weaker in decolorizing effect than the German earth. The numerical results are tabulated. W. S. E. C.

665.521.2 : 66.094.57

1488. Recovery of Spent "Doctor" Solution. J. C. Albright. *Nat. Petr. News*, 16.9.36, **28** (38), 24R.—Spent "doctor" solution is regenerated by heating and blowing air through it, when lead sulphide is oxidized to lead sulphate which redissolves in the excess of caustic soda. This process is usually accomplished by heating the solution by means of closed steam coils and blowing air through "spiders" in the tank bottom.

In order to increase the efficiency of air/solution contact, a baffled pipe 12 ft. long and 6 in. diameter has been installed at one plant. Air and spent "doctor" solutions at 165° F. are recirculated through this "contacter," and the usual regenerating time of 24 hours has been reduced to 2 hours. H. G.

665.542

1489. Ammonia in Petroleum Refining. Anon. *Petr. Times*, 1936, **36**, 393, 429.—Anhydrous ammonia is finding increasing use as a means of combating corrosion. Salt and hydrated magnesium chloride in the crude cause rapid corrosion in condensing equipment, as does the hydrochloric acid used in the acidizing of wells drilled through limestone formations. Such corrosion has been reduced to a minimum by introducing anhydrous ammonia at a point in the plant in advance of the location of the trouble. Ammonia is stored in 150-lb. cylinders, and is introduced into the plant through a flow meter or reducing valve and pressure gauge for the proper control of the amount used. Corrosion by hydrochloric acid has been successfully prevented in crude-oil distillation, cracking, and the degumming of gasoline. Similarly, troubles due to SO_2 in the re-running of acid-treated distillates, H_2S in the re-fluxing of naphtha, and the decomposition products of the various solvents used in solvent extraction plants have been overcome. The cost of such treatment is not great. With ammonia

at 20 cents per pound and used at the rate of 4 lb. per 1000 brls. of crude, the cost is 16 cents per 100 brls. of finished gasoline, assuming that the gasoline yield is 50%. The control of the amount of ammonia used is of great importance, the criteria being the *p*H value of the aqueous condensate and its content of the metal constituting the equipment.

With Admiralty metal tubes a *p*H value of 7–7·3 and with steel tubes 7–7·6 is recommended. Many advantages are claimed for the ammonia treatment of acid-treated pressure distillate. Among these advantages are: (1) less emulsification; (2) greatly reduced settling time and better separation of reagents and sludge; (3) the pressure distillate can be run straight to storage; (4) the pressure distillate is cleaner to re-run and causes less corrosion; (5) greater colour stability of the gasoline owing to the reduction of the amount of organic sulphur bodies present. H. G.

665.54 : 662.9 : 608.3

1490. Patents on Refinery Plant. W. S. Gullette and T. B. Kimball. U.S.P. 2,055,452, 22.9.36. Improved furnace for heating hydrocarbon fluids. W. S. E. C.

Cracking.

66.092.122.2

1491. Unusual Design Cracking Unit. J. C. Albright. *Refiner*, 1936, **15**, 349–351.—The Dubbs unit operated by the Naph-Sol Refining Co. Muskegon charges 1250 brls./day reduced Central Michigan crude and produces 56·5% gasoline (sp. gr. 0·732, A.S.T.M. octane number 68) and 30–31% fuel oil. Unusual features of this unit are (i) the flash and bubble columns are combined in one tower, (ii) the furnace consists of two compartments or cells fired from the top with gas or fuel with preheated air; the two sections provide means for combination feed on one side and side cut cracking or reforming on the other, and (iii) a horizontal salt-removing drum is placed between the fuel-oil bottoms/charge heat exchangers and the bubble column, water being introduced into the charge on the suction side of the charge pump to dissolve the salt crystals. G. R. N.

66.092.16 : 608.3

1492. Patents on Cracking. E. A. Ocon. U.S.P. 2,052,721, 1.9.36. Cracking in two separately controlled zones, of hydrocarbons of relatively low and relatively high mol. wts., and subjecting the products to common fractionation and condensation.

66.092.42 : 608.3

J. F. Wait. U.S.P. 2,052,812, 1.9.36. Cracking of hydrocarbons in the presence of alkali metal to promote molecular rearrangement and association of fixed gases with the vapours.

66.092.42 : 608.3

D. S. Villars. U.S.P. 2,053,211, 1.9.36. Objectionable heavy constituents formed during cracking are removed with molten metal, *e.g.* aluminium, lead or an alloy of these two metals.

66.092.12 : 608.3

H. V. Atwell. U.S.P. 2,053,213, 1.9.36. Cracking in a single cracking zone of several different types of oil and recycling the oil in order to attain the desired specifications.

66.092 : 608.3

J. C. Morrell. U.S.P. 2,055,015, 22.9.36. Cracking of hydrocarbon oils to produce greater yields of high anti-knock spirit and coke of low volatility.

66.092 : 608.3

V. Henny. U.S.P. 2,055,028–2,055,029, 22.9.36. Cracking of coke to obtain a tar oil which is converted at high temperatures into high anti-knock motor fuel.

66.092.8 : 608.3

G. W. Miller. U.S.P. 2,055,085, 22.9.36. Uncondensed vapours from liquid-phase cracking are polymerized and divided into two fractions—the lighter fraction is returned to the cracking zone and the heavier fraction is conveyed to the flashing zone without previous cracking.

66.092 : 608.3

E. W. Zublin. U.S.P. 2,055,212, 22.9.36. Improved expander units for use in cracking operations.

66.092.42 : 608.3

R. F. Ruthruff. U.S.P. 2,055,313, 22.9.36. Cracking of hydrocarbon oils in the presence of molten materials.

66.092.42 : 608.3

M. Pier. U.S.P. 2,055,633, 29.9.36. Cracking of tars or oils at high temperatures in the absence of added hydrogen in an apparatus fitted in those parts coming into contact with the hot distillate, with a coating of zinc–iron alloy. W. S. E. C.

Hydrogenation and Polymerization.

66.094.17 : 608.3

1493. Patents on Hydrogenation. J. Y. Johnson. E.P. 452,512, 25.8.36. Improved preheater for hydrogenation processes.

66.094.17 : 608.3

Int. Hydrogn. Patents Co., Ltd., and I.G. E.P. 454,132, 24.9.36. Heat treatment of residues from the destructive hydrogenation of coal in contact with hot molten metal, *e.g.* lead in the presence of steam and nitrogen as a flushing gas.

66.094.1 : 608.3

J. Y. Johnson. E.P. 454,173, 25.9.36. Generation of gaseous mixtures rich in hydrogen by the conversion of hydrocarbon gases and solid fuels with steam at high temperatures and applying a catalyst if necessary.

66.094.1 : 608.3

J. Y. Johnson. E.P. 454,391, 30.9.36. Hydrogenation of coals, mineral oils or their products at 380–550° C. and under pressures above 50 atms., in the presence of a catalyst consisting of an added solid substance previously produced by oxidation of graphitic acid and which has been pretreated with H_2S or H_2S and NH_3 before use in the reaction.

66.094.1 : 608.3

M. Pier and W. Kroenig. U.S.P. 2,054,776, 15.9.36. Hydrogenation of asphaltic carbonaceous substances using as catalyst molybdic acid suspended in lubricating oil. W. S. E. C.

66.095.26 : 608.3

1494. Patents on Polymerization. A. Carpmaël. E.P. 453,854, 18.9.36. Polymerization of olefines at 50° C. and under pressure in the presence of boron fluoride or compounds of boron fluoride containing at least one hydrogen atom capable of removal by dissociation. W. S. E. C.

66.095.26 : 608.3

J. A. Guyer. U.S.P. 2,054,599, 15.9.36. Polymerization of olefines and pyrolysis of paraffins to produce gasoline.

66.095.26 : 608.3

B. Malishev. U.S.P. 2,055,415, 22.9.36. Production of lubricating oils by treating low-boiling unsaturated hydrocarbons in the anhydrous conditions at polymerizing temperatures with anhydrous phosphorous pentoxide suspended in a solvent.

66.095.26 : 608.3

J. M. Caudri. U.S.P. 2,055,425, 22.9.36. Production of lubricating oils from gasoline by polymerization using as catalyst, active aluminium chloride.

66.095.26 : 608.3

J. C. Morrell. U.S.P. 2,055,875, 29.9.36. Polymerization of gaseous olefines in the presence of aqueous hydrogen chloride and zinc. W. S. E. C.

Motor Fuel.

665.521.2

1495. Hypochlorite Treating. H. Bottomley. *Refiner*, 1936, **15**, 359–362.—Sweetening with hypochlorite is very satisfactory when used on H_2S-free natural gasolines, all straight-run distillates relatively free from olefins and aromatics, and some refinery recovery gasolines depending on the unsaturate content of the same. It can be applied by the batch or continuous method using the ordinary type of washing plant. The sweetening effect is the same as that of plumbite, *i.e.* conversion of mercaptans to disulphides, the oxygen of the hypochlorite uniting two molecules and eliminating hydrogen. A moderately active sodium hypochlorite solution should have 10–12 gm./litre available chlorine and an excess alkalinity of at least 4·0 gm./litre NaOH. Soda ash may be used in place of caustic soda to make up the reagent, but in general is not preferred. Calcium hypochlorite is a cheaper reagent, and can be satisfactorily employed, but its chief advantages are disposal of insoluble lime sludge and slightly greater tendency to form emulsions during treating. A third modification of this class of reagent is bleaching powder, which is used either as a slurry or as a decanted solution. Average figures for treating typical Mid-Continent distillates are 1 to 1·5 cents/brl. for sodium hypochlorite and 0·75 cents/brl. for calcium hypochlorite.
G. R. N.

665.521.2

1496. Continuous Treating Plant Design. R. T. Howes and C. N. Whitaker. *Refiner*, 1936, **15**, 363–365.—Describes a plant for acid, then soda, treatment of naphtha or pressure distillate of low initial and low operating cost. It is essentially a contact tower of small diameter and four towers of larger diameter in series all containing special packing. The oil is circulated by means of a low head centrifugal pump at velocity sufficient to obtain efficient contact in the contact tower. A feed pump discharges into the contact tower in parallel with the circulating pump. The first two large towers are desludgers, whilst the third is employed for neutralization, the caustic soda being pumped in batch. The fourth tower is a reserve to remove moisture after neutralization. The special packing causes the sludge to coalesce into heavy droplets, which fall to the bottom of the tower. Sludge or caustic which may accumulate on the packing after a long period of operation is easily removed by steaming. A rotameter is recommended for measuring the rate of flow of acid. A water wash is not required. G. R. N.

665.521.2

1497. Stoicheiometry and Natural Gasoline Plants. R. L. Huntington. *Refiner*, 1936, **15**, 352–355.—An article designed to assist operators in securing a reasonably accurate knowledge of the material balance of a typical natural gasoline plant inadequately equipped with metering devices. With the aid of routine analyses of raw gas, absorber residue gas, uncondensed vapours from still to reabsorber, residue gas from reabsorber, stabilizer residual gas and finished propane free gasoline, simple methods of calculating the volumes of residue gas from the absorber, the stabilized gasoline, the residue vapours from the reabsorber and stabilizer, the raw make gasoline to the stabilizer and the uncondensed raw make tank vapours are given. G. R. N.

665.521.2

1498. Progress in Natural Gasoline Extraction. J. W. Vaiden. *Petr. Eng.*, Sept. 1936, 7 (13), 40.—During the past year the greatest progress in natural gasoline extraction

has been in the simplification of excess equipment at one time thought necessary for efficient operation.

The unstability and falling value of the natural gasoline made by compression resulted in 1930 in the development of fractionation, which has now superseded the compression and absorption methods owing to its greater efficiency and reduced equipment needed. A greater impetus is now added by the increasing demands for propanes and butanes. Fractionating columns now separate also pentanes, hexanes, heptanes, octanes and several intermediate fractions for solvent, etc., purposes.

A patent has been applied for to cover the lowering of oil rates by saturating absorption oil with the vent gases at the plant, the heat of absorption being removed by cooling before the "enriched" lean oil enters the main absorber. The temperature rise in the main absorber is thus reduced, permitting a reduction in oil rate. At the same time improved absorption is given owing to the higher number of liquid mols. in the absorber. The addition of the vent gas constituents reduces the partial pressure of the pentanes and heavier left in the oil in the still, thus giving greater extraction efficiency. Little additional absorption of methane, ethane and propane takes place at the top of the absorber, thus giving lower temperatures of oil on the top plate, lowering the partial pressure of the desirable compounds. In pipe-line plants this process permits the return of all or most of the vent gases to the line without the aid of a recompressor. C. L. G.

665.531.2

1499. Motor Fuel from the Catalytic Treatment of Cracked Gases. G. Egloff. *Petr. Times*, 1936, **36**, 527.—A typical plant for the production of polymer gasoline consists of a heater, catalyst chamber, condenser, receiver and equipment for regenerating the catalyst. Gas is heated to 450° F. and passed, with a little steam, through three towers arranged in series and containing "solid phosphoric acid catalyst." The reaction is exothermic, and the temperature in the reaction chambers rises to 550° F. The uncondensable gases from the receiver are burnt as fuel, whilst the overhead gas from the stabilizer is cracked or dehydrogenated to provide extra charging stock. The structure of a hydrocarbon has a marked influence on its octane number, as is illustrated by the following examples. Normal pentane, O.N. 64; 2:2-dimethylpentane, O.N. 83; 2-methylbutane, O.N. 90. The yield of polymerization products increases as the content of butene and propene increases, and when butene is present in larger quantity than propene. Studies of the constitution of polymer gasoline show it to contain relatively few hydrocarbons, but none has been positively identified. One investigation showed polymer gasoline to contain 48·1% of 7 C atom bodies. Its blending octane number depends on that of the balance of the blend, and increases as the latter decreases. The octane rating of di*iso*butene (C.F.R. Motor Method) is 84, and when blended with Reference Fuel A3, octane number 44, its octane rating is 153–95 for concentrations of 5–75%. H. G.

665.521.2 : 665.542 : 608.3

1500. Patents on Motor Fuel. A. C. Vobech and L. P. Foster. U.S.P. 2,053,752, 8.9.36. Removal of sulphur compounds from light distillates by the action of caustic soda.

665.521.2 : 665.542 : 608.3

H. L. Kerr. U.S.P. 2,053,909, 8.9.36. Removal of sulphur compounds from light petroleum distillates by the action of a solution of sodium ortho plumbate and sodium plumbite.

665.521.2 : 665.541 : 608.3

R. E. Manley and W. Ullrich. U.S.P. 2,054,774, 15.9.36. Refining of cracked distillates by passing them through a bed of very finely-divided solid absorbent material.

665.521.2 : 665.542 : 608.3

R. B. Day. U.S.P. 2,055,027, 22.9.36. Refining of petroleum distillates by the addition of aqueous hydrogen chloride in the presence of zinc chloride at 500–650° F. and 400 lbs. pressure/sq. in.

665.521.2 : 665.542 : 608.3

F. R. Moser. U.S.P. 2,055,416, 22.9.36. Refining of cracked spirit to obtain a good fuel oil by treatment with the vapours of organic sulphonic acids substantially free from sulphuric acid at 100–250° C.

665.521.2 : 665.542 : 608.3

A. Belchetz. U.S.P. 2,055,423, 22.9.36. Sweetening of petroleum distillates by converting the mercaptans to disulphides. W. S. E. C.

Lubricants and Wax.

621.892.096

1501. Hydrodynamical Theory of Piston-ring Lubrication. R. A. Castleman. *Physics*, 1936, **7**, 364.—Careful measurements of piston-ring surfaces made by the Bureau of Standards reveal that the bearing surface of a worn ring is not plane, but consists of two surfaces meeting at a small angle. Applying the lubrication theory of Reynolds and Michell to such a case, coupled with the assumption that lubricating oils under engine conditions cannot stand absolute tension, shows that there will be a net dynamical pressure forcing the ring outwards. The static pressure, *i.e.* the pressure due to the gas above the ring, operates both on the back of the ring and on the bearing surface, and so cancels out.

Applying the theory to a typical case, a mean clearance of 0·0009 cm. is found. This distance is several times the molecular size, and supports the contention that boundary lubrication will not be obtained in such a case.

High wear occurs when a new ring is being run in until it assumes the profile necessary to give viscous lubrication, as shown by the theory. The theory is also in agreement with the known facts that ring clearance is smallest and cylinder wear greatest at the top ring at top dead centre. P. D.

621.892.16

1502. Voltolization Process for the Production of Premium Motor Oils. G. M. Woods. *Petr. Eng.*, Sept. 1936, **7** (13), 15.—The voltolization process consists of subjecting an oil under reduced pressure to a high-tension silent electrical discharge of relatively high frequency, resulting in dehydrogenation with subsequent polymerization of the olefin material formed. The process yields oils of high viscosity, higher viscosity index than that obtainable by solvent extraction, and improved oiliness. Paraffin wax, petrolatum or oil may be voltolized, it being necessary to remove the unreacted material always present by vacuum distillation. The greater the intensity of the electrical treatment, the more viscous, and better viscosity index oils are produced, a V.I blending value of 380 being obtainable. Such highly treated oils are also good pour-point reducers.

Details are given of a laboratory voltolization of a blend of 50% crude scale wax and 50% waxy Mid-Continent distillate, an oil of V.I of 123 being produced by distillation, dewaxing and filtration of the treated oil. The estimated production cost of the above oil is estimated at 38 c. per gallon, but in actual practice it may be less owing to the quantity of current used on the laboratory scale (15 K.W. hr. per gal. of oil). A similar test using four times as much current produced an oil which when added to 90 parts of a finished M.C. paraffin-base motor oil improved the viscosity index from 90 to 119. The addition of 1, 2 and 5% of this voltolized oil to an oil of 30° F. pour point reduced this figure to 10, −5° and −15° F., respectively.
C. L. G.

621.891.22

1503. Addition of Chlorine Compounds to Lubricants to Increase the Film Strength. B. T. Lincoln, G. D. Byrkit and W. L. Steiner. *Ind. Eng. Chem.*, 1936, **28**, 1190.—Film strengths determined by means of a modified Timken machine are given for 80 different chlorine-containing organic substances, tested in 1% concentration in mineral oil. The results are also expressed in terms of a Timken Index, which is the difference between the film strength of the blend and of the original oil, divided by the chlorine content of the addition compound. By means of this index, generaliza-

tions are presented, attempting to correlate the structure of the addition compound with the resulting film strength. Further with 0·75% of methyldichlorostearate in a highly acid-treated Mid-Continent paraffin-base mineral oil, road tests show that the effect of the addition of this substance substantially reduces the wear.

J. W. H.

665.521.5 : 665.543.061.5

1504. Recent Developments in Selective Solvent Extraction. R. S. Fusstieg. *Petr. Eng.*, Sept. 1936, **7** (13), 36.—Following a brief outline of the progress in the refining of lubricating oils a discussion is presented of the theoretical considerations underlying the use and selection of single and double solvents. Particular reference is made to an extraction process for the removal of undesirable components from the extract. The value of solvent selectivity is stressed, reference being made to the improvement in selectivity of liquid SO_2 effected by the addition of benzole. A description is given of a seven-stage two-solvent process, which, although more expensive in first cost than a single-solvent plant, owing to the necessity for two solvent recovery units, is stated to give products of unusual stability, low carbon residue, and negligible sulphur content even from high sulphur stocks. The choice of a naphthenic solvent for use in the double-solvent process depends on the following characteristics: (*a*) selectivity for naphthenic oil increased by presence of propane; (*b*) limited miscibility with propane in the presence of oil; (*c*) high solubility for non-paraffinic compounds, but some solubility for paraffinic material; (*d*) high specific gravity (to promote rapid separation between two layers); (*e*) critical solution temperature in range of 115–165° F. to permit operation at normal temperature and pressure; (*f*) final boiling point not above 425° F.; (*g*) low melting point; (*h*) reasonable price; (*i*) availability in large quantities. Cresylic acid is the organic solvent which most nearly meets the above requirements. Where used alone it produces high-grade lubricating oils, but has a high solubility for paraffinic compounds. With oils of high naphthenic content, high specific gravity or high viscosity, separation is therefore so poor as to make its use impracticable. It is therefore used with propane, and gives a high yield of valuable lubricants.

The advantages of propane lie in its availability for dewaxing by self-refrigeration. The author has found that the addition of phenol improves the selectivity of cresylic acid.

A difficulty with present solvent extraction processes is the production of an extract containing large quantities of undesirable components, and which can be utilized only by oxidation of the extract to asphalt or drastic refining with sulphuric acid. Kwal (*Rev. de Chim. Ind.*, 1935, No. 526, p. 282) has worked out a method for double solvent extraction of the extract, one solvent—phenol—separating the paraffinic hydrocarbons in the extract and another—*m*-nitrobenzylic alcohol—separating the non-paraffinic hydrocarbons from the undesirable components (asphaltic compounds). The results of tests on a Polish distillate and residuum are given, the yields being 62% of raffinate containing aliphatic compounds, 34% of raffinate containing naphthenic compounds and 4% of asphalt from the distillate oil, and 70%, 26% and 4% respectively from the residuum treated.

C. L. G.

621.892.212 : 608.3

1505. Patents on Lubricating Oil. Internat. Hydrogn. Pat. Co., Ltd., and H. S. Birkby. E.P. 452,811, 31.8.36. Preparation of lubricating emulsifier.

621.892.212 : 608.3

I.G. Co. E.P. 453,139, 4.9.36. Manufacture of products of the nature of petroleum jelly.

665.521.5 : 665.543.3 : 608.3

Stand. Oil Dev. Co. E.P. 454,176, 25.9.36. Dewaxing of hydrocarbon oils using a solvent mixture consisting of at least two of the following components: one from the group containing dichlorethylene, or dichlorpropane and the corresponding bromine and fluorine compounds, and the other from the group containing dichlorethylene, dichlorpropylene and the corresponding bromine and fluorine compounds.

621.892.25 : 668.3

A. S. Leavesley and I.C.I. Ltd. E.P. 454,386, 29.9.36. Manufacture of a lubricating composition of a paste-like nature consisting of glycerol and methyl glycol cellulose and sodium oleate.

665.521.5 : 665.543.061.5 : 668.3

O. F. Simons and F. C. Craxton. U.S.P. 2,053,000, 1.9.36. Solvent fractionation of hydrocarbon oils using a solvent consisting of 20–95% of liquid SO_2 and 5–80% of a liquid olefine hydrocarbon containing 2–5 carbon atoms/molecule.

621.892.212 : 665.542.2 : 668.3

D. D. Stark and T. O. Edwards. U.S.P. 2,052,852, 1.9.36. Refining of lubricating oil with acid and then clay-treating.

665.521.5 : 665.543.061.5 : 668.3

M. R. Fenske and W. B. McCluer. U.S.P. 2,052,971, 1.9.36. Solvent extraction of lubricating oil.

621.892.25 : 668.3

H. R. Snow. U.S.P. 2,053,209, 1.9.36. Method of forming slurries of lime in oil as a final product of the process of mixing lime, water and petroleum oil.

665.521.5 : 665.543.3 : 668.3

L. D. Jones. U.S.P. 2,053,337, 8.9.36. Dewaxing of lubricating oil by solvent extraction using as solvent a compound of the formula $C_4H_8Cl_2$ of b. pt. 136° and sp. gr. 1·1375.

665.521.5 : 665.543.061.5 : 668.3

H. F. Lindeke and B. S. Greensfelder. U.S.P. 2,053,485, 8.9.36. Refining of lubricating oil by solvent extraction using benzole, or a mixture of benzole and naphthalene, etc.

665.521.5 : 665.543.3 : 668.3

S. A. Montgomery. U.S.P. 2,053,872, 8.9.36. Propane dewaxing of lubricating oils.

665.521.5 : 665.543.061.5 : 668.3

L. A. Clarke. U.S.P. 2,054,050, 8.9.36. Solvent refining of lubricating oil using methyl *ortho*-aminobenzoate.

665.521.5 : 665.543.061.5 : 668.3

F. X. Govers. U.S.P. 2,054,052, 8.9.36. Solvent refining of lubricating oil using furfural.

665.521.5 : 665.543.3 : 668.3

F. X. Govers. U.S.P. 2,054,416, 15.9.36. Dewaxing of hydrocarbon oils using a solvent consisting of 35% of acetone and 65% of phenol.

665.521.5 : 665.543.3 : 668.3

E. C. Knowles. U.S.P. 2,054,429–2,054,430, 15.9.36. Dewaxing of hydrocarbon oil using a mixture of dipropyl ketone and methyl ethyl ketone.

665.521.5 : 665.543.3 : 668.3

R. E. Manley. U.S.P. 2,054,433, 15.9.36. Dewaxing of hydrocarbon oil using furfural.

665.521.5 : 665.543.061.5 : 668.3

H. T. Bennett. U.S.P. 2,054,613, 15.9.36. Apparatus for producing lubricating oils of high viscosity index by solvent extraction.

665.521.5 : 665.543.061.5 : 668.3

E. B. Hjerpe and W. A. Gruse. U.S.P. 2,054,750, 15.9.36. Refining of lubricating oils by solvent extraction using a mixture of ethylene dichloride, benzole and liquid SO_2.

665.521.5 : 665.543.3 : 608.3

E. F. Pevere. U.S.P. 2,054,775, 15.9.36. Dewaxing hydrocarbon oil using dialkylether.

665.521.5 : 665.543.3 : 608.3

M. Pier and A. Eisenhut. U.S.P. 2,055,135, 22.9.36. Dewaxing hydrocarbon oil using propane.

621.892 : 608.3

R. S. Vose. U.S.P. 2,055,210, 22.9.36. Improvement in quality of lubricating oils by dehydrogenating the unsaturated hydrocarbons by means of colloidally dispersed sodium metal.

665.521.5 : 665.543.061.5 : 608.3

R. J. Dearborn. U.S.P. 2,055,428, 22.9.36. Solvent extraction of lubricating oils using liquefied propane and sulphur dioxide.

665.521.5 : 665.543.3 : 608.3

L. C. Kettering and L. H. Robertson. U.S.P. 2,055,627, 29.9.36. Dewaxing hydrocarbon oil using petr. ether, ethyl alcohol, naphtha, acetone, acetone-benzole, etc. W. S. E. C.

665.521.6 : 608.3

1506. Patents on Wax. C. Ockrent, N. Bennett and I.C.I. Ltd. E.P. 452,659, 26.8.36. Manufacture of oleic acid derivatives of paraffin wax.

665.521.6 : 608.3

C. Ockrent, N. Bennett and I.C.I. Ltd. E.P. 452,660–452,662, 26.8.36. Manufacture of unsaturated products from chlorinated paraffin wax.

665.521.6 : 608.3

E. I. Du Pont de Nemours & Co. E.P. 453,522, 14.9.36. Manufacture of ethers and esters of paraffin wax.

665.521.6 : 608.3

Sylvania Industrial Corpn. E.P. 453,438, 8.9.36. Method of prevention of rancidity in light-unstable oils, fats and waxes.

665.521.6 : 608.3

J. J. Ward. U.S.P. 2,054,777, 15.9.36. Recovery of wax from crude oil. W. S. E. C.

Fuel Oil.

662.753.32 : 621.43.019

1507. Combustion Qualities of Diesel Fuel. G. D. Boerlage and J. J. Broeze. *Ind. Eng. Chem.*, 1936, **28**, 1229.—In an analysis of the combustion process in the C.I. engine, the possible sources of loss of efficiency are examined. After-burning, which is a common cause of inefficient and smoky combustion, is stated to be due to uneven distribution of the fuel and to slow evaporation of fuel deposits on the combustion chamber walls.

It is shown that the fuel may influence the mixing process on account of its viscosity its volatility and its ignition quality, and that the best value for each characteristic varies with the engine type.

Since the measurement of volatility is so important in the estimation of combustion efficiency and consequent carbonization, the authors consider that improved test methods should be sought.

The chemical considerations of after-burning and the formation of unburnt products are examined, and the causes of various imperfections in the operation on engine are given. J. G. W.

Asphalt.

665.521.8

1508. Vacuum Distillation Operation of an Asphalt Unit. Anon. *Refiner*, 1936, **15**, 369.—Heavy Arkansas crude containing a high proportion of asphaltic residuum is processed as follows: It is first passed through the electric dehydrator to remove salt, then through a surge drum to the primary convection coil. It leaves at 230° F., entering the primary fractionating column from which the small proportion of gasoline is taken off overhead. The tower bottoms return to the furnace and, leaving at 700° F., enter the secondary fractionating column, from which overhead tractor distillates and side stream gas oil are removed. The bottoms from this tower are pumped back to the furnace and through the secondary convection coil, from which they are transferred at 710° F. to the vacuum column held at an average vacuum of 26 ins. mercury. An overhead lubricating distillate is taken off and the asphaltic residuum representing 45% of the crude is pumped through coolers to storage. Automatic control is such that any grade of finished asphalt, flux or road oil can be obtained.
G. R. N.

665.521.8 : 608.3

1509. Patents on Asphalt. A. Gutzwiller. U.S.P. 2,055,459, 22.9.36. Apparatus and method for the continuous production of blown asphalts. W. S. E. C.

Special Products.

547.213

1510. Synthesis of Cyclopropane. H. B. Hass, E. T. McBee, G. E. Hinds, and E. W. Gluesenkamp. *Ind. Eng. Chem.*, 1936, **28**, 1178.—*cyclo*Propane has recently attracted some attention on account of its use as an anæsthetic. In this paper the authors report a new method of preparing *cyclo*propane which should make this substance available at a reasonable price. The essential steps in the syntheses are as follows: propane is chlorinated in the vapour phase at 400° C. with the production of all four isomeric dichlorides. The relative percentages of dichlorides in the crude chlorinated material are, in order of boiling point: 2 : 2-dichloropropane, 25·5%; 1 : 1-dichloropropane, 19·6%; 1 : 2-dichloropropane, 35·6%, and 1 : 3-dichloropropane 19·3%. Thus only one-fifth of the crude dichlorides is the 1 : 3-dichloride, which is the only one of the four isomers capable of yielding *cyclo*propane on ring closure. Ease of chlorination and subsequent separation, and the low initial cost of propane and chlorine, make this process an economical one for the preparation of 1 : 3-dichloropropane, in spite of its low yield. The 1 : 3-dichloropropane is now treated with zinc dust in excess, the solvent being 75% ethyl alcohol, 25% water, a mole of anhydrous sodium carbonate for each mole of 1 : 3-dichloropropane, and one-sixth mole of sodium iodide. A yield of 95% crude *cyclo*propane was obtained in twelve hours, the reaction temperature being 125° C. By using acetamide as well as sodium carbonate and reducing the quantity of sodium iodide improved yields were obtained in a shorter time. H. E. T.

547.279.3

1511. Utilization of Sulphur Compounds obtained from Mineral Oils. F. Schmeling. *Oel und Kohle*, 1936, **12**, 837–840.—A description is given of the preparation of thioethers, sulphides and disulphides from crude mercaptans. The products are stated to be used in the manufacture of special solvents, pharmaceuticals, wetting agents, insecticides, etc. P. G. H.

547.914

1512. Resinous Derivatives of Vinyl Alcohol. G. O. Curme and S. D. Douglas. *Ind. Eng. Chem.*, 1936, **28**, 1123.—A brief survey of the properties and uses of vinyl polymers. Various characteristics of this type of polymerization product are pointed out which set them apart from other products in the resin field. On account of the rapidity with which the use of resins is spreading in industry, it is thought that vinyl polymer resins will soon hold an important place among this class of compounds.
H. E. T.

547.914

1513. Dispersing and Wetting Properties of Resins Prepared from Cracked Distillates. C. A. Thomas and F. J. Soday. *Ind. Eng. Chem.*, 1936, **28**, 1174.—The following are shown to be the advantages accruing from the replacement of phenolic and natural resins, by a hydrocarbon resin, in the preparation of paints and enamels. The rate of flow of a titanium dioxide pigment in a vehicle composed of 50% of hydrocarbon resin and 50% of mineral spirit is very high when compared with other commercial resins, whilst the rate of settling of pigments in vehicles containing a hydrocarbon resin is low. Further, the time required for the grinding of titanium dioxide and lithophone pastes in a vehicle containing a hydrocarbon resin is lower than for other resins. J. W. H

66.062.2

1514. Petroleum Solvents for Use in Paints for Tropical Regions. E. M. Toby, Jr. *Paint Technology*, 1936, **1**, 321–324, 330.—In formulating a composition for use in the tropics a set of conditions must be considered comprising high humidity, sudden and heavy rainfall, high temperatures and sun's rays which are direct and contain a higher proportion of actinic rays.

Experience has shown that for these conditions modern synthetic resins are most suitable, and these require high-solvency thinners which can be supplied by the petroleum industry. White spirit and petroleum naphtha are the two petroleum fractions most used.

The A.S.T.M. specification for white spirits, although covering the average grade, leaves several loopholes by which material of inferior specification might be acceptable. It is suggested that the purity specification might be tightened and a provision for solvency value tests included. The Kauri-Butanol value, aniline point and dimethyl sulphate value might be of some use in evaluating the solvent properties, but in practice the test would be best based on the particular resin type to be used.

The solvent power of two spirits were tested by determining the proportion of xylol to be added to the spirit to give thinner formulæ of a minimum safety value.

Petroleum naphtha should have a short boiling range, and if easy brushing is desired, the I.B.P. should be sufficiently high and the end point low enough to ensure tack-free drying within the specified time.

Besides these solvents, several other general types of petroleum solvent are employed.

Flat wall finishes require a slower drying thinner than white spirit. It is customary with these paints to blend white spirit with kerosine, but this has a tendency to cause a spotty finish.

Manufacturers are now using a closely fractionated slow-drying solvent with I.B.P. 350° F. and an end point of 460° F. These fractions give faster drying than kerosines, and are much more satisfactory.

In floor waxes and some varnishes an intermediate fraction between white spirit and naphtha with a flash point over 80° F. is becoming popular.

Another class of solvents are the toluol and benzole substitutes for use in lacquers. The toluol substitutes usually have I.B.P. 200° F. and end-point 265° F. They must evaporate completely before such active solvents as butyl acetate and butyl alcohol have evaporated from the film, otherwise precipitation of nitrocellulose may occur. A nitrocellulose tolerance test is often used for the examination of these solvents.

Benzole substitutes are mainly used in those lacquers or dopes used in the manufacture of artificial leathers. Their use eliminates the risks of benzole poisoning.

D. L. S.

661.183.2 : 608.3

1515. Patents on Special Products. N.V. Octrooien Maat., "Activit." E.P. 453,627, 15.9.36. Preparation of highly active carbonaceous substances having colloidal characteristics by mixing finely-divided carbonaceous substances with a water-absorbing substance, preferably sulphuric acid, in a partially closed vessel at 250° C.; condensation products developed during the reaction are allowed to escape.

66.092.2 : 608.3

H. P. Stephenson. E.P. 454,011, 22.9.36. Production of solvents for use in cleansing spirit, lacquer and rubber industries from coal-oil mixtures.

547.211 : 608.3

J. P. Baxter and I.C.I. Ltd. E.P. 454,577, 2.10.36. Manufacture of fluoro-chloro derivatives of methane by the action of chlorofluoride of antimony on carbon bisulphide. W. S. E. C.

Coal.

662.742 : 608.3

1516. Patents on Coal. J. Swallow. E.P. 452,702, 27.8.36. Apparatus for the distillation of coal and hydrocarbon oil.

668.731 : 608.3

Sharples Specialty Co. and Bethlehem Steel Co. E.P. 453,630, 15.9.36. Removal of tar acids from tars produced incidental to the manufacture of coke by adding to the tar material, an aqueous solution containing 10–25% of caustic soda by wt.

662.742 : 608.3

C. J. Greenstreet. U.S.P. 2,054,725, 15.9.36. Production of liquid fuel by distillation of a coal-oil mixture. W. S. E. C.

Engines.

621.385.83

1517. Interpretation of Oscillograms. R. R. Batcher. *Instruments*, 1936, **9**, 255.—The interpretation of oscillograms devoted to measurements of frequency is discussed. P. D.

621.385.83

1518. Special Forms of Cathode-ray Tubes. R. R. Batcher. *Instruments*, 1936, **9**, 231.—Besides the use of cathode-ray tubes for oscillographic work there are other uses, which are described in this article. These include voltage indicators, deflection controlled oscillators, frequency multipliers and radio direction finders. The production of canal rays is also considered. A further type of tube is that producing Lenard rays, and a modern example of such a tube is described. P. D.

621.43–634.2

1519. Origin and Development of the Heavy Oil Engine. A. T. Bowden. *J. Inst. Mar. Eng.*, 1936, **48**, 235–254.—This paper gives an outline of the history of the oil engine from the patents of Ackroyd Stuart in 1890 to the present day. Many famous designs are described and illustrated, and many fields of application are covered, including ship propulsion, stationary engines for many purposes, rail cars, aero engines, and road transport.

The success of the heavy oil engine in most fields is assured, but it remains to be proved that this type of engine can supplant or even compete with the steam locomotive for general rail transport. Its greatest handicap in the air is its low power/weight ratio, but the author thinks it may in time become universal in this field if and when it is developed as an air-cooled two-stroke. C. H. S.

662.61

1520. Thermal and Time Factors of Carburation. J. Small. *J.I.P.T.*, 1936, **22**, 706–725.—Experiments are described on the evaporation of gasoline in an air stream from which it is concluded that when an I.C. engine has just started a negligible amount of the gasoline enters in the form of vapour, and ignition may and no doubt does in a cold engine commence from a liquid particle, which comes within the high temperature range of the spark. G. R. N.

Economics and Statistics.

621.43(47)

1521. Petroleum Industry in the U.S.S.R.—Motor Vehicles. I. Ganitzki. *Mon. Petr. Roum.*, 1936, **37**, 1317–1319.—In 1925, the U.S.S.R. production was seven lorries a month, but factories were established at Moscow, Gorkii and Jaroslavli for mass production on Ford principles and patents. By 1932, the outputs for that year were 15,149 Moscow, 1219 Jaroslavli and 7697 Gorkii. A rapid increase followed, and in 1935 a total of 96,700 vehicles were turned out, which in 1936 is expected to reach 161,500. The stock at the end of 1936 will be 86,000 cars, 156,000 1½-ton lorries, 116,000 heavy lorries, 19,500 buses and 15,500 special vehicles (dust carts, etc.). In 1932–1936 the Gorkii works turned out 42,000 " Gaz A " models—open Fords, light and with transverse springs. These were most uncomfortable. In March 1936 this was changed to a limousine type, M.1, the 1934 Ford 4-cylinder stream-lined model. The Moscow works (" Zis ") are designed to turn out 70,000 3-ton lorries and 10,000 7-seater limousines as well as buses. Production of the latter, 22 seaters, 75-h.p. engine, max. speed 60 km./hr., began in the summer of 1936. A factory for building 5-ton lorries is to be constructed at Samara in 1937, as well as other works at Stalingrad and Novosibirsk for 3-ton lorries. New models expected are gas-propelled 1½-ton lorries (from Moscow) operating on wood, charcoal, coke or anthracite. Diesel engines have been tried on 5-ton lorries in a 5000-km. race. The most economical were the Ganz-Iendrassik, 51 h.p. at 1650 r.p.m., 4-cyl., 140 mm. bore × 104 mm. stroke. The paper describes other factories under construction, and the question of road development is considered. A great motor road from Moscow to Khabarovsk and Vladivostok is under construction; this will be 9251 km. in length.

W. E. J. B.

622.323(794)

1522. Future Supply of Oil in California. F. E. Minshall. *Oil Weekly*, 5.10.36, **83** (4), 37.—In order to maintain California supply of and demand for oil in balance it is necessary that reserves be increased, during the next five-year period, approximately 2,000,000,000 brls. to approach an ultimate reserve of 10,000,000,000 brls. It is suggested that these additional reserves will come from the known oil provinces by the discovery of deeper sands in known proved fields, by redrilling wells in old fields, by drilling deep tests or by the discovery of buried structures by geophysics.

L. V. W. C.

658.2 : 665.4/5(497.1)

1523. Petroleum in Jugo-Slavia. Anon. *Mon. Petr. Roum.*, 1936, **37**, 1373–1374.—Exploratory work has not given positive results, with the single exception of a zone near Lazina, but to the north of Sava, near Bujavitza and Basadul a high-pressure gas well has been brought in. The development of refineries near Brod and Zaprag has led to greatly increased imports of crude oil, *e.g.* about 16,000 tonnes in 1925 has increased to 90,000 tonnes in 1935. A customs tax of 3 dinars per 100 kgms. of imported crude, first applied in 1931, appears to have checked the rise in the figures of imported crude.

The price of motor spirit varies with the part of the country, the lowest price being in the north, near Rumania. Detailed import figures for various grades are given for 1934 and 1935. The latter year showed a definite decline, particularly in motor spirit and kerosine. The article sets out the various customs and consumption taxes for petroleum products.

W. E. J. B.

662.75(4)621.892(47)

1524. Liquid Fuels and Lubricating Oils. Oil and its Products—Russia. Anon. *Rev. Comb. Liq.*, 1936, **14**, 282–285.—There has been a pronounced drop in Russian oil exports from 4,894,452 tonnes in 1933 to 3,334,096 tonnes in 1935, the fall from 1934 to 1935 being 21·9%. This drop is almost entirely due to increased domestic demands. Army requirements have been primarily responsible for intense motorization in Russia, the extension to agricultural needs being slight and secondary. Only quite recently have motor vehicles acquired any status for transport purposes.

The first Five-year Plan called for the development of tractors, reapers and other motorized agricultural machines, but although there was an increase in some of these machines, trucks were produced only in very small numbers. Railways monopolized development to the almost entire exclusion of motor transport. Except in big towns the motor vehicle is still a *rara avis*. Last August 72% of the motor vehicles were confined to merchandise transport. The production of automobiles has increased considerably during these last years. The second Five-year Plan calls for a final production of 630,000 vehicles/annum, equivalent to about the combined production of Great Britain and Germany for 1935.

Such an intense production requires a long-established preliminary organization and personnel with technical knowledge. Again, the roads are for the most part in a very primitive condition, and there are no distribution stations, garages, repair shops, etc. In Aviation great progress has been made. The final impression is that the advance so far made is only an indication of future evolution. However, even if motorization development does not respond to the Plan's forecasts, it is certain that the domestic requirements of Russia must continue to increase. On the other hand, an equivalent increase of production cannot be expected; therefore Russia must progressively curtail her exports, which have been and still are steadily declining. In addition to increased domestic demands there has been a deficit in the production prescribed by the Plans.

Statistics show that the production in 1931 was about 22,323,000 tonnes, and new drilling amounted to 707,363 m. In 1934 a production of about 24,000,000 tonnes required 1,256,000 metres of new drilling. Thus each metre drilled in 1931 produced 31·57 tonnes of oil to only 19·23 tonnes/metre in 1934. In 1935 the ratio appears worse. It is impossible to expect an arrest in domestic demands and, on the other hand, the U.S.S.R. Government is very unlikely to abandon entirely exports of oil. Therefore it is indispensable that most serious efforts be made to increase production; consequently considerable orders for material have been given to the U.S.A.

Any hopes of increasing the production from the old-established oil regions have been abandoned, because they appear to have reached, if not passed, their zenith. The new equipment has been ordered principally for the development of a new "oil base" in the Ural region, where it is hoped to build up a production of 4,000,000 tonnes/annum in a very short time. M. Stalin's programme lays down the attainment in the five years of the old oil-field's production of 25,000,000 tonnes/annum. Such a gigantic result seems problematical. Professor Goubkin recently published in *Isvestia* calculations on the possible oil reserve in this region as being 1000 million tonnes. This is admittedly hypothetical, since the area is almost equal to that of France, and only about one-fourth of it has undergone a bare geological reconnaissance. His figures are based on some 260 domes expected to be saline and analogous to the Texas–Louisiana domes, some of which are given, by study, a reserve of 5 million tonnes, and on the hypothesis that 20% of the 1100–1200 possible domes in the whole region are petroliferous. It is argued that Professor Goubkin's more modest figure of a production in two or three years of 2,500,000 tonnes/annum is more feasible than M. Stalin's ordained requirements. Even if the Ural-Emba region is a very rich petroliferous territory, it would only afford a small relief to the probable domestic requirements of Russia in the next few years.

Contrast between the Ural-Emba territory and the Baku oil-fields shows that the Baku oil-fields are almost contiguous and of small superficial extent, fully equipped and well supplied with all kinds of transport. The Ural-Emba is an immense stretch of country with great distances between the oil-fields. Other differences from Baku are: unfavourable climate, desert country, scarcity of water, bad or non-existent transport facilities, lack of technical equipment, scarcity of manual labour, scattered and nomadic indigenous population.

Astonishment is expressed at the Government's neglect of the new oil-field at Pirsagat, near Baku, which has hardly been seriously worked, and it is suggested that the reason for this neglect may be more gaps in the Government means of operation than will be admitted.

B. F. N. M.

REVIEWS AND BOOKS RECEIVED.

Reviews.

621.436

HIGH-SPEED DIESEL ENGINES. L. H. Morrison. 243 pp. 126 figs. 1936, American Technical Society, Chicago. $2.50.

This book has been written to acquaint the American public with the essentials of high-speed diesel engine design and behaviour, and is intended to appeal particularly to prospective owners of such engines.

Following a brief introduction, in which the rapid growth of the high-speed diesel engine and the reasons leading to increases in engine speed are mentioned, a chapter is devoted to the need for complete combustion. An elementary outline is given of the general effects of atomizer and combustion chamber design, combustion knock and turbulence.

The next chapter deals with fuel-injection systems and the principles of jerk pump action with variable-stroke pumps and with constant-stroke pumps having quantity control by suction valve throttling, spill valve and by-pass ports. Various fuel pumps are described in detail including the Bosch, Ex-Cell-O, and Cummins systems.

Diesel fuels for high-speed engines form the subject of the fourth chapter, which refers to engine tests in terms of cetene and α-methylnaphthalene. Details are also given of fuel grading by the aniline number and "diesel index," and the effects of viscosity, carbon residue and other factors.

The next chapter describes crankcases and cylinders and includes some data regarding liner wear. Chapter VI is devoted to moving parts such as crankshafts, connecting rods, pistons and rings, valve gear and the camshaft, and the remainder of the volume gives descriptions of well-known American engines, including the Cummins, Fairbanks Morse, Buda-M.A.N., Caterpillar, Allis-Chalmers, Waukesha-Hesselman, Waukesha-Comet, McCormick-Deering, Winton, and Hercules, with two chapters on European aviation diesel engines and lorry engines.

Although the information in this type of book must be drawn largely from manufacturers' catalogues and instruction books, the author has succeeded in producing a readable and useful volume free from many of the unnecessary repetitions which so often occur in publications of its class, and it can be thoroughly recommended to anyone wishing to obtain up-to-date non-technical information on the subject.

Certain statements need revision, although few of them are such as to affect the general value of the book for the public for whom it has been prepared. Among these statements is one to the effect that direct injection in high-speed diesel engines is limited to cylinder bores of at least 6-inch and preferably 8-inch diameter. The Gardner engine is a very successful example of an engine with a much smaller bore where direct injection is used with extremely good economy, and this engine is not even mentioned in the section dealing with European designs.

The paragraph on thermal efficiency of the diesel cycle needs revision, especially in respect of the implication in the definition of compression ratio that this ratio is the same as that between suction and maximum pressure.

It is said, also, that research has indicated that the wear of a cylinder liner, regardless of engine size, is approximately 0·001 inch per 1000 hours of operation, although, in the next paragraph, a figure of 0·003 inch per 1000 hours is given for a 4-inch bore cylinder. It should not be difficult to amend this section in a later edition. Useful comment is made on the need for care to avoid distortion of liners due to uneven tightening up of cylinder head bolts.

The chapter on fuel characteristics is one of the most complete semi-technical reviews of its subject which has been published in any book dealing with high-speed diesel engines but it may be questioned whether the Conradson value should, theoretically, be a guide to the amount of carbon and other non-combustibles in the oil, or whether an oil with a 2 per cent. Conradson value can contain as much as 10 per cent. of constituents impossible to be burned in an engine. R. STANSFIELD.

31

STATISTICAL YEAR-BOOK OF THE WORLD POWER CONFERENCE. No. 1. 1933 & 1934. Edited by Frederick Brown, B.Sc.(Econ.), F.S.S. Pp. 111. 1936, World Power Conference, London. £1.

As the result of a resolution passed in 1926, the World Power Conference undertook the preparation of forms and definitions of terms and units in an attempt to compile and publish international statistics of power resources, development and utilization upon a comprehensive and comparable basis. Early in 1936 an experimental edition of the Year-book was issued for comment and criticism. The present work, which is considered to be still experimental, covers the years 1933 and 1934, and includes data relating to solid, liquid, and gaseous fuels, and water power and electricity.

This review is necessarily concerned with that part of the book which relates to petroleum, and it is disappointing to find that the kilolitre has been adopted as the unit of liquid volume. In the petroleum-industry the gallon or the barrel are the units most generally used for liquid measurement. In this connection another point of importance arises, and that is with regard to the conversion factors used in the compilation of this work. In 1932 the Institution of Petroleum Technologists published a booklet on "Measurement of Oil in Bulk. Part I. Standard Weights and Measures," in which standard conversion factors for the various units used in the industry were given. These factors were arrived at in consultation with authoritative bodies in Great Britain and the United States, and it is to be regretted that the World Power Conference has decided to use other factors. That this is likely to cause some confusion is evidenced by the figures given for the production of crude petroleum in 1933 and 1934 as 236·6 and 246·9 millions of metric tons, respectively. The United States Bureau of Mines, a recognized authority on such matters, gives figures of 197·2 and 208·4 millions of metric tons for the same years, whilst the figures published by the Imperial Mineral Resources Bureau are 196 and 209 millions of long tons. These variations are no doubt also due to a certain extent to the lack of reliable information on the specific gravities of the various crude petroleums.

The tables also include information relating to refining, import, and export activities, and the scarceness of such data is emphasized by the large number of blank spaces in the columns. It is certain, however, that much more information could have been included, although this would possibly have meant a slight departure from the strict outline of the special forms used for the collection of the figures.

The various National Committees of the World Power Conference are mostly given as the organizations responsible for the completion of the standard statistical forms, and it is to be hoped that in future editions the actual sources of the information will be quoted in every case. It is noticeable that the Statistische Jahrbuch für das Deutsche Reich is the source of certain statistical data for several countries, such as Colombia, Ecuador, Mexico, Iran, etc., and one wonders why the official publications of these countries have apparently not been consulted.

While the reviewer fully realizes that the work of compiling comparable statistics relating to all activities in the production and refining of petroleum, and the trade of the petroleum industry, is a tremendous task, and one which requires considerable courage to undertake, he feels that the arrangement of the work under review requires amendment in detail if it is to be useful in clarifying the statistics of petroleum.

GEORGE SELL.

Books Received.

620.1

A.S.T.M. STANDARDS ON PETROLEUM PRODUCTS AND LUBRICANTS. Pp. vi, 372. 1936, American Society for Testing Materials, 260, S. Broad St., Philadelphia. $2.00.

The current (1936) edition of the compilation of *A.S.T.M. Standards on Petroleum Products and Lubricants*, which is sponsored each year by Committee D-2, gives in their latest approved form fifty-six methods of test, five specifications and two lists of definitions of terms relating to petroleum and to road materials.

The 1936 report of Committee D-2 discusses the research and standardization work, details the changes made in the standards, and also gives four proposed methods which have been approved for publication as information and for comment. They cover the determination of kinematic viscosity with the suspended level viscosimeter

and by the modified Ostwald viscosimeter, converting kinematic viscosity to Saybolt, and a test method for neutralization number (potentiometer method).

The D-2 report also gives suggested uniform automotive engine lubrication recommendations and there is discussion of the development of colour standards for the A.S.T.M. Union Colorimeter.

Standards are given in the publication pertaining to a large number of petroleum products.

Copies of this publication can be obtained from the offices of the Institution, price 8*s.* 6*d.*, postage extra.

620.1

A Survey of the Present Organization of Standardization National and International. Pp. viii, 55. 1936, World Power Conference, London. 3*s.* 6*d.*

The Central Office of the World Power Conference has, with the assistance of its National Committees, assembled the facts regarding national organization of standardization, and this report has been made available in order to stimulate to a greater degree unification in national standardization and a closer co-operation of the activities of international organizations now engaged in standardization of materials or methods. Details are given of the national standardizing bodies in thirty-three countries, together with information regarding the four principal organizations concerned with international standardization.

Natural Gasoline Association of America:

665.521.2

Proceedings of the Fifteenth Annual Convention, 1936. Pp. 64. 1936, Natural Gasoline Association of America, Tulsa, Oklahoma.

The Fifteenth Annual Convention of the Natural Gasoline Association of America was held at Tulsa, Oklahoma, May 13th–15th, 1936. The papers presented to the Convention are contained in the present volume together with the report of the discussions which took place.

Natural Gasoline Supply Men's Association:

665.521.2

Technical Information Booklet. Pp. 104. 1936, Natural Gasoline Supply Men's Association, Tulsa, Oklahoma.

This book contains technical information regarding natural gasoline and its refining, including many charts and tables regarding the physical properties of gasoline and hypetroleum drocarbons.

621.436

Oil Engines for Road, Rail and Air Transport. Pp. 240. 3rd Edn. 1936, Temple Press, London. 5*s.*

The two previous editions of this book appeared under the title "Compression Ignition Engines for Road Vehicles." In the present volume the various types of oil engine used in road, rail and air transport are fully discussed, and much information is given regarding their characteristics, fuels and lubricants, operating costs, and maintenance. The book is copiously illustrated, and includes a Glossary of Technical Terms and a Directory of Manufacturers.

U.S. Bureau of Mines:

628.54: 614.777

R.I. 3318. Disposal of Oil-field Brines in the Arkansas River Drainage Area in Western Kansas. C. J. Wilhelm, H. M. Thorne, and M. F. Pryor. Pp. 28. 1936, Superintendent of Documents, Washington, D.C.

This report represents the results of a study, carried out by the Bureau of Mines under a co-operative agreement with the Kansas State Board of Health, in the oil-producing fields within the Arkansas River Drainage Area, west of Hutchinson, with particular reference to the disposal of oil-field brines. Information has been gathered on the present methods of disposal, and on the difficulties in disposing of brines in sub-surface formations. Corrosion tests on sub-surface disposal systems are also included.

ABSTRACTS AUTHOR INDEX.

The numbers refer to the Abstract Number.

Abegg, W. A., 1134
Abele, R. P., 649
Adam, L., 63
Adams, C. E., 707
Adams, F. W., 904
Adams, J. E., 859
Adams, W. C., 1177
Adamyan, L. K., 563, 968, 971
Afanasdev, B. N., 202
Ahlberg, C. R., 438
Ainslee, W., 297
Albright, J. C., 34, 118, 211, 213, 214, 215, 217, 373, 374, 376, 504, 575, 655, 688, 918, 1062, 1129, 1150, 1175, 1213, 1319, 1383, 1488, 1491
Alco Products Inc., 1217
Alden, R. C., 924
Aldridge, B. G., 827
Aldrin, E. E., 931
Aleksandrov, L. A., 564, 800
Alexanian, C. L., 289, 1185
Allen, A., 523
Allen, A. O., 91
Alther, J. G., 412
Amery, G., 607
Anderson, A., 1127
Anderson, A. P., 943
Anderson, D. Q., 471
Anderson, G. H., 1217
Anderson, J. A., 588, 707
Anderson, R. O., 114
Andrau, E. W. K., 737
André, R., 304
Andreev, L., 693
Andrews, C. A., 18
Andrews, C. W., 901
Angell, C. H., 1199
Anglo-Iranian Oil Company Ltd., 168
Annable, W. G., 539
Anschicka, R. J., 40
Anthony, C. G., 317
Arbuzov, V. S., 410
Arce, E. H., 466
Archibald, F. M., 76, 588
Armestrant, A. L., 674
Armstrong, G. J., 114
Armstrong, R. T., 777, 778
Arnold, C., 588, 817, 827
Aruntunoff, A., 507
Arutyunov, M. S., 1368
Asadov, I. M., 377
Ashdown, A. A., 777, 778
Asprey, R. W., 1084
Asquini, A., 468
Assheton, R., 175, 1244, 1370
Aston, J., 866
Atlantic Refining Company, 827, 1084
Atwell, H. V., 1080, 1189, 1492
Auld, S. J. M., 441
Avanesova, S. M., 968
Ayres, E. E., 384

Babson, E. C., 113
Backus, H. S., 667
Badger, W. L., 906
Baender, F. G., 945, 1084
Bagirov, K. N., 311, 567
Bahlke, W. H., 694
Bahr, T., 128
Baichikov, A. G., 834
Baidakova, R., 1382
Bailey, D. P., 276
Bailey, J. R., 685
Baker, A. A., 4
Baker, J. G., 1139
Baker, H. W., 1029
Baker, R. C., 368
Baker, W. L., 199, 369
Bakianov, B., 1144
Balada, A., 144
Balázs, A., 1405
Baldeschwieler, E. L., 89, 264
Balk, R., 324
Balyabo, I. K., 407
Barkelew, J. T., 1134
Barker, R. W., 622
Barnes, J. B., 414
Baron, C., 626
Barr, G., 136, 250
Barrabé, M. L., 14
Barret, W. M., 201
Bart, E., 1382
Bartholomew, F. J., 663
Barton, C. H., 829, 1226
Barton, D. C., 330
Baskin, C. M., 306
Bass, N. W., 325
Bataafsche Petroleum Mij., 76, 159, 433, 443, 463, 603, 639, 707, 716, 817, 827, 975, 1080, 1084, 1095, 1217, 1394, 1405
Batcher, R. R., 182, 183, 399, 605, 718, 842, 976, 1517, 1518
Bateman, W. H., 767
Batten, W. E., 769
Bauer, S. G., 1230
Baxter, J. P., 1515
Bayley, C. H., 74
Beale, C. O., 604
Beale, E. S. L., 181, 254
Beall, I. N., 1170
Beard, L. C., 936, 1063
Beard, R. E., 1219
Beardmore, H. F., 384
Beardsley, W. H., 588
Beatty, H. A., 550
Beck, Koller & Company, 693
Beck, H. V., 654, 656, 1015, 1481
Beckwith, L. B., 453
Bedur, G. K., 1033
Beecham, T. E., 588
Behlmer, O., 414
Behnke, G. E., 756
Beilin, A. E., 836
Beitler, S. R., 1464
Beichetz, A., 1500
Beichetz, L., 235
Bell, A. H., 1142
Bell, O., 1391
Bencowitz, I., 956
Benedict, W. L., 265, 673
Bennasar, J., 1333
Bennett, E. O., 1134
Bennett, H. T., 296, 1084, 1505
Bennett, N., 1506
Bennett, V. D., 520
Bent, F. A., 715
Benz, C. C., 588
Berestavsky, E. V., 704
Berger, C. W., 1207
Berlin, R. I., 312
Bertram, E. A., 665
Betancourt, N., 1102
Bethlehem Steel Co., 1191, 1516
Bettis, W. L., 1134
Beynon, L. G., 1086
Bierhalter, W., 85
Bignell, L. G. E., 22, 27, 195, 207, 348, 479, 485, 509, 516, 739, 872, 991, 992, 1269, 1302, 1306, 1307, 1308, 1450, 1459
Bilbao, E. S., 188
Bilikin, V., 726
Birch, S. F., 807
Bird, A. L., 1230
Bird, J. C., 603
Birkby, H. S., 1505
Birkhimer, E. R., 443
Bissell, W. T., 296
Black, J. C., 290
Black, L. C., 1299
Blagodorov, M. L., 586
Blau, L. W., 40, 639, 1002, 1119, 1277, 1434
Block, H. C., 756
Blow, G., 874
Blum, W., 658
Blümner, E., 982
Boe, E. S., 956
Bocharova, E. M., 284
Boerlage, G. D., 1229, 1507
Boerlage, G. M., 403
Bogolyubskii, V., 360
Böhme, H. T., 415
Boiling, E. H., 1484
Bolidens Gruvaktiebolag., 1173
Borel, J., 1065
Born, S., 973
Borsig-Maschinenbau A.-G., A., 573
Bortz, S. M., 377
Boru, W. T., 354
Bösenberg, H., 172, 301
Bost, R. W., 242
Both, S., 406
Botset, H. G., 189, 1431
Bottomley, H., 1345, 1495
Boulanger, L., 414
Bowden, A. T., 1519
Bowles, V. O., 670
Bowman, R. A., 905
Boyd, J., 1002
Boyd, J. H., 1070
Boynton, A., 1442
Brack, J. D., 1442
Bradley, G. W. J., 290
Brame, J. M., 1099
Bramlette, M. N., 327
Brandes, O. L., 679
Brantly, J. E., 1010
Brasseri & Co., H. A., 1009
Bratton, A. C., 685
Braude, E. M., 451
Bray, U. B., 453, 463, 588, 827, 1217
Brazhnikov, V. T., 771, 1205
Bredberg, L. E., 381, 1455
Brenner, A., 658
Breth, F. W., 939
Breton, J., 1254
Brewster, W. G., 28
Briand, M., 316
Bridgeman, O. C., 1381
Bridges, R. B., 1027
Briner, R., 54
Bristow, W. A., 1255
British Thomson-Houston Company, 79, 515, 663
Broche, H., 585
Broese, J. J., 828, 1229, 1507
Brooks, B. T., 156, 333, 408, 470
Broom, W. E. J., 140, 251, 252
Broughton, G., 904
Brown, C. C., 507
Brown, C. J., 1155
Brown, B. S., 1208
Brown, G. C., 422, 1074
Brown, G. G., 1184, 1410
Brown, L. T., 929

Brownlie, D., 948, 981
Brownsdon, H. W., 821
Bruce, R. N. B. D., 1357
Brunn, J. H., 774, 893, 1344, 1352
Bryson, H. C., 967
Buc, H. E., 931
Buck, E. O., 858, 1153
Buddine, N. T., 272
Buerger, C. B., 276
Bukh, D. N., 1222
Burford, S. O., 102
Burger, P., 178
Burk, R. E., 579, 707
Burkhard, M. J., 1191
Burmah Oil Company, Ltd., 79
Burns, E., 368
Burwell, A. W., 1347
Buti, P., 159
Butkov, N. S., 912
Buwalda, J. P., 517
Byran, R. W., 1304
Byrkit, G. D., 1503
Byudov, A., 283
Bywater, W. M., 1099

Calderwood, A. H., 1231
Calingaert, G., 543, 550, 676
Cambron, A., 74
Camelford, J. A., 1347
Camp, J. F., 1436
Campbell, A. W., 1050
Campbell, H. C., 91
Campbell, J. A., 795
Campbell, S. E., 1080
Candea, C., 1356
Canépa, E. P., 187
Cannon, M. R., 1215
Carbide & Carbon Chemicals Corporation, 603, 716, 830, 975
Carbo-Norit Union, 935
Carceller, J., 54
Card, R. H., 491
Carey, W. F., 573
Carlson, C. G., 108
Carlstrom, J., 414
Carnahan, F. L., 1052, 1348, 1469
Carney, B. R., 585
Carpenter, I. C., 1084
Carpenter, M. T., 579
Carpmael, A., 663, 923, 1201, 1405, 1494
Carr, D. E., 1217
Carr, R. H., 40
Carrozzi, R., 156
Carruthers, T. F., 603, 716
Cassidy, T. A., 1005
Castleman, R. A., 1501
Catland, A. C., 756
Caudri, J. M., 1494
Cavins, O. A., 756
Cawley, C. M., 159, 1220
Celiz, J. A., 121, 1412
Cerchez, V., 583
Challener, W. A. P., 1065
Chaney, L. V., 76, 290, 433, 585
Charigin, M. M., 382
Charrin, P., 345, 489
Chase, G. F., 588
Chatfield, H. W., 1237
Chave, C. T., 687
Chebotar, L. P., 704
Chemical Construction Corporation, 537, 663
Chemical Works, 415, 603
Chenault, R. L., 378
Chilcote, J. M., 209
Child, W. C., 831
Childs, W. L., 1299
Chittick, M. B., 1217
Christensen, L. M., 929, 1377
Church, W. L., 114, 507, 1275
Ciusa, W., 416
Clancourt, H. de, 635
Claffey, L. W., 1352
Clapp, F. G., 508, 1109
Clark, A. M., 769
Clark, J. M., 1192
Clark, L. V. W., 41, 501
Clark, R. P., 739
Clark, W. L., 649
Clarke, L. A., 79, 443, 1084, 1505
Clasen, A., 1134
Clough, K. H., 729, 1297, 1419
Coberly, C. J., 210, 1290, 1442
Codier, G., 817
Colburn, A. P., 909
Cole, H. A., 790
Collard, J., 492
Collins, J. F., 248
Collins, J. O., 831
Comay, S., 1080
Compagnie de Bethune, 1374
Compagnie Des Mines Vicoigne, Nouex et Drocourt, 913
Conine, R. C., 219, 379, 380, 860, 1313
Conn, A. L., 904
Connolly, J. A., 114
Consitt, N., 1099
Conway, M. J., 915
Cook, M., 1012
Cook, R., 581
Cooke, M. B., 153, 282, 1190
Corey, W. H., 328
Corning, L., 477
Corson, B. B., 914, 1045
Corwin, W. S., 730
Cottrell, O. P., 433
Coubrough, G. B., 412, 530
Coutts & Company, 168, 576, 707, 1200
Cowell, R. E., 1099
Cox, E. R., 129, 885
Cozzens, F. B., 1444
Crackett, L. O., 1217
Craig, H. J., 756
Craig, L. C., 892
Cramer, P. L., 675
Crandell, J. S., 84
Crawford, F. A. F., 1065
Crawford, J. W. C., 975
Craxton, F. C., 1505
Creek, W., 1290
Crick, C. S., 649
Crider, A. F., 338, 1416
Cromwell, N. H., 1050
Crosby, R. H., 585
Crowell, R. V., 1299
Crowley, H. G., 1084
Crumley, J. A., 368
Cryder, D. S., 1182
Csagoly, J., 83
Culbertson, A., 1442
Cunningham, W. A., 100
Curme, G. O., 1512
Currier, N. B., 117
Curtis, H. A., 707
Curwen, M. D., 458
Cuthill, J., 640

Daimler-Benz A.-G., 977
Dale Condit, D., 1259
Dalyrymple, D., 634, 1429
Danehy, J. P., 1470
Danse, L. A., 437
Davenport, E. S., 867
Davenport, J. B., 1346
Davey, W. S., 599
Davis, A. F., 1327
Davis, E. L., 1449
Davis, G. H. B., 817
Davis, H., 1191
Davis, H. M., 1158
Davis, R. A., 756
Davis, R. F., 290
Davis, W. N., 706
Day, R. B., 433, 585, 1208, 1217, 1500
Dean, D. K., 799
Dearborn, E. J., 433, 1505
Decker, C. E., 474
Degea, A.-G., 977
Delbel, G., 897
Deiss, E., 960
Delbridge, T. G., 434
Dengler, F. S., 306
Deussen, A., 482, 737
Deutsche Gasolin A.-G., 827
Deutsche Hydrierwerke A.-G., 716
Deutsche Röhrenwerke, 176
Diehl, W. L., 1134
Dietrich, K. R., 426, 1077
Diggs, S. H., 568, 1219
Dijk, W. van, 296
Dimmig, H., 72
Dintzes, A. L., 275
Dix, C. H., 351
Dobryanski, A. F., 791, 917
Dockendorff, R. L., 1340
Docksey, P., 254
Dodds, E. M., 157
Doherty, W. T., 495
Doladugin, A. I., 447
Dolbear, C. E., 585
Dokdi, S., 1204
Dolgov, B. N., 284
Dolton, R. H., 1190
D'Oncieu, J., 855
Donlan, T. R., 588
Donnelly, J. Y., 1199
Dons, E. M., 604
Doormaal, P. M. van, 955
Dorey, S. F., 683
Dornte, R. W., 940
Dougherty, J. P., 414
Douglas, S. D., 1477, 1512
Dowzard, E., 257
Doynel, L., 421
Drake, N. L., 245
Dreyer, W. C., 111, 350, 1324
Dreyfus, H., 156, 663
Dryer, C. G., 700
Drysdale, J. K., 1304
Dubbs, C. P., 276
Dubbs, L. A., 1190
Dubrovai, K. K., 382
Duckham, A., 827
Duffing, G., 822
Dumple, W. H., 368
Dunstan, A. E., 62, 922
Du Pont de Nemours & Company, E. I., 443, 603, 704, 802, 830, 1095, 1200, 1506
Durier, Y., 927
D'Yarmett, E. C., 799, 801
Dyer, W. S., 764

Easton, H. D., 339, 860
Eaton, J. P., 760
Ebaugh, L. A., 436
Eberle, W. A., 707
Ebert, G., 156
Eby, J. B., 488
Eddy, G. E., 1273
Edeleanu Gesellschaft, 1394
Edmister, W. C., 1471
Edson, F. H., 414
Edwards, C. R., 1442
Edwards, T. O., 1505
Egerton, A. C. G., 704
Egloff, G., 70, 152, 154, 265, 276, 554, 673, 678, 700, 701, 812, 817, 898, 1194, 1195, 1224, 1371, 1378, 1499
Ehring, K., 1011, 1022
Ehrmann, K., 585
Eichengrün, A., 463
Eisenhut, A., 1505
Eliel, L. T., 1417
Elliot, G. R., 856
Ellis, B. W., 1343
Ellis, L. A., 1326, 1463
Eming, E., 65

Emrick, B. R., 496
Endres, A. F., 290
Englin, B. A., 447
Engs, W., 156
Erdheim, E., 137, 560, 796, 797, 1061, 1487
Erk, S., 1051
Erlikh, B. M., 565, 969
Eru, I. I., 277
Ershevskaya, M. P., 275
Espach, R. H., 946
Evans, E. A., 78
Evans, E. B., 157
Evans, J., 224
Evans, L. T., 588
Evans, P., 496, 497
Evans, R. N., 1346
Evans, S., 40
Evers, F., 1054
Ewing, S., 50, 120

Faingar, M. M., 451
Fallah, R., 41
Faragher, W. F., 694
Farmer, J. O., 1435
Farrington, B. B., 706
Faulconer, W. B. M., 1344
Faulkner, F. L., 825
Federov, V. S., 356
Feiler, P., 156
Felder, D. H., 306
Felsing, W. A., 685
Fenner, C. N., 724
Fenske, M. R., 139, 431, 690, 707, 932, 1182, 1183, 1215, 1217, 1505
Ferguson, C. V., 940
Ferguson, W. B., 334
Ferris, S. W., 588, 1084
Field, E., 1351
Fields, J. D., 296, 443
Fieser, L. F., 60, 61
Finaton, C., 1267, 1422
Fischer, E. J., 1232
Fischer, F., 128, 388
Fisher, A., 1099, 1199
Fisher, E. K., 139
Fisher, R. P., 368
Fister, L. H., 1191
Fitzsimons, O., 256, 1208
Flaherty, J. H., 868
Flemming, E. L., 114
Fletcher, H. W., 40, 394, 756, 1442
Flood, T. B., 748
Flood, W. H., 591, 1017
Florez, L. de, 276, 414, 1065
Florian, E., 558
Flury, W. J., 1299
Foote, P. D., 740
Footner, H. B., 659
Forbes, E. J., 589
Forney, W. E., 1198
Forrest, H. O., 585, 943
Fortine, D. H., 1174, 1363
Forward, W. L., 874
Foss-Manchind, E., 106, 342
Foster, A. L., 155, 603, 809, 953
Foster, L. P., 1500
Fox, C. E., 368
Fragen, N., 906
Franchetti, P., 163
Frantzuz, E., 283
Fraser, W. M., 690
Free, G., 783
Freure, B. T., 839
Frey, F. E., 698
Fry, E. M., 932, 1348
Fuidge, G. H., 832
Fürst, R., 110
Fusnteg, R., 303, 708, 1069, 1373, 1504

Gabler, G. C., 47
Galliher, E. W., 95
Gamble, D. M., 1483
Ganitzchi, I., 124, 186, 320, 321, 322, 612, 613, 614, 848, 1039, 1100, 1414, 1415, 1521
Gard, E. W., 412
Gardner, E. W., 306
Gardner, J. H., 515
Garner, F. H., 140, 157, 251, 1228
Garrett, J. B., 99
Garton, E. L., 51
Gary, W. W., 414, 817, 1066
Gas Light & Coke Company, 537, 1357
Gates, L. G., 756
Gavrun, E., 1367
Gee, G., 696, 697
Gee, P., 944
Gee, W. P., 79
Geissler, D. W., 712
Geissler, W., 1234
Gemant, A., 666, 1300, 1479
Gemmer, R. W., 1002
Genieese, J. C., 817
Gerasimov, M., 428
Gerr, V. F., 1241
Gervant, Y., 1382
Gesell. für Linde's Eismaschinen A.-G., 1484
Getzen, V. B., 232
Gheorghiu, M., 293
Gibson, G. F., 1096
Gierhart, G. B., 98
Giffen, E., 180
Gifford, H. W. F., 817, 847
Gilbert, L. C., 82
Gilbert, W. E., 17
Gilbert, W. V., 945
Gilfoil, W. S., 800
Gillespie, C. P., 368
Gilliland, E. R., 417, 670
Ginsburg-Karagitschewa, T., 1424
Givaudon, J., 1221
Glaessner, M. F., 1423
Gleason, G. W., 765
Glendinning, E. V., 1399
Gluesenkamp, E. W., 1510
Gluizdenek, V., 385, 534
Godlewicz, M., 561
Goldsby, A. R., 677
Goiendeev, V. P., 1242
Golyer, E. de, 203, 346
Gomory, W. L., 72, 296
Good, D. B., 1038
Goodwin, N., 414
Goodyear, G. H., 677
Gordon, K., 150
Gotting, H. E., 1099
Gough, H. J., 509
Govers, F. X., 827, 1084, 1217, 1505
Grace, H. E., 209
Grace, W. S., 874
Graefe, E., 105
Graham, H. W., 865, 868
Graham, W. H., 874
Grant, J., 28
Gray, T. T., 76, 579
Green, H. F., 1084
Green, W. G., 639
Greenfield, E. W., 787
Greenfelder, B. S., 707, 1505
Greenstreet, C. J., 1516
Greenwood, H. D., 897
Gregory, P. P., 30
Griffin, C. W., 1349
Griffith, R. H., 782, 1357
Grigor'ev, V. M., 1236
Groll, H. P. A., 1080
Groote, M. de, 234, 539, 664, 1177
Grosholz, R., 785
Gross, H. F., 1217
Gross, H. H., 707, 827, 1084, 1217
Grosse, A. V., 156, 237, 674, 704, 1043, 1068
Grosselli Chem. Co., 923
Groves, W. W., 839
Grozdovskaya, R. I., 1294
Grune, H. M., 114
Gruse, A. V., 433
Gruse, W. A., 679, 704, 1082, 1084, 1217, 1505
Guenter, E. A., 1123
Guismann, T. A., 806
Guillette, W. S., 1490
Gunness, R. G., 670
Gurd, G. W., 588
Gurwich, G. B., 838
Gusman, D., 826
Gutehoffnungshütte Oberhausen A.-G., 1005
Gutzwiller, A., 1509
Guyer, J. A., 1191, 1494
Gyro Process Company, 801

Haalck, H., 109
Hackford, J. E., 150, 982
Haeuber, H., 156
Haferer, D. W., 1299
Hagemann, A., 1225
Hager, J. J., 1050
Hagerman, T. H., 1104
Hague, E. N., 62
Halder, M. L., 521, 1020
Haines, M. W., 368, 756
Halbouty, M. T., 105, 357, 498, 644, 645, 738
Hall, F. C., 442
Halpern, M., 418
Halse, G. W., 2
Hammer, O., 209
Hammerich, T., 1078, 1225
Hampton, A. C., 801
Hancock, W. T., 694, 1101, 1199
Hanlon, H., 1299
Harger, D. K., 1217
Hargrove, G. C., 694
Haringhuizen, P. J., 291, 660
Harrell, D., 1462
Harrington, G. G., 1299
Harris, F., 778
Harris, H. A., 1120
Harris, J. McA., 296, 588
Harris, L., 777
Harrison, C. F. B., 769
Harrison, J. W., 414
Harry, R. G., 1402
Hart, W. B., 901
Hartley, A. C., 657
Hartnell, G., 1116
Haslam, R. T., 802
Hass, H. B., 547, 549, 1510
Hassler, G. L., 1134
Haupt, W. H., 209
Hausman, J., 449
Havel, H., 486
Haylett, R. E., 1216
Haymann, D. F., 1336
Headington, C. E., 295
Heald, K. C., 1005
Hearne, G., 1080
Hecht, M., 1217
Hedley, J. B., 194
Heilman, R. H., 1181
Heiman, S., 413
Heinze, R., 286, 419
Heisig, G. B., 788, 1158
Henderson, L. M., 296, 588
Hennion, G. F., 776
Henny, V., 1217, 1492
Herbert, W., 156
Herbert, W. F., 761
Herbsman, A. M., 117
Hernek, H. N., 756
Herpig, F., 987
Herrick, H. N., 117
Herrmann, P., 300
Herschberg, E. B., 60
Herthel, E. C., 694
Herzog, E. J., 1288

Hetzel, T. B., 444
Hewgley, J. M., 117
Hicks-Bruun, M. M., 774
Hieland, C. A., 996, 1000
Hill, F. F., 114
Hill, J. B., 801
Hill, S. G., 782
Hille, H., 709
Hinds, G. E., 1510
Hirsch, R. E., 139
Hjerpe, E. B., 1084, 1217, 1505
Hladky, J. W., 543
Hodge, E. B., 549
Hoffman, E. B., 594
Holland, C. J., 174, 305
Hollings, H., 1357
Holm, M. M., 1376
Holmes, A., 831
Holsen, E. F., 1180
Holzman, E. 267
Hontcharenko, I., 190
Hoota, H. W., 1113
Hoover, C. O., 817
Hoover, G. R., 306
Hopper, B., 588, 827
Hopton, G. U., 537
Horn, L. van, 943
Horn, W., 649
Horner, W. L., 728, 1420
Horsley, G. F., 156
Hottel, H. C., 1187
Houdrey, E. J., 694
Houdry Process Corpn., 1065, 1191
Howard, J. H., 507, 756, 1134, 1299
Howard, W. R., 1199
Howe, H. V., 631
Howes, D. A., 62, 922
Howes, R. T., 1208, 1496
Hsich, C. Y., 103, 671
Hubner, W., 445, 1224
Hude, J. W., 742
Huff, L. C., 694, 801
Hughes, J. D., 112, 208, 361, 500, 871
Hulster, J. de, 59
Hultin, C. T., 454, 1193
Hume, H. V., 950
Humphrey, H. C., 40
Humphreys, H. S., 532
Hunt, T. N., 114
Hunter, T. G., 68, 440, 945
Huntington, R. L., 524, 916, 1154, 1172, 1355, 1456, 1457, 1497
Hupkes, W., 1252
Hurd, C. D., 677
Huston, R. C., 671
Hutchinson, N. M., 510
Hutchison, K., 537
Hyatt, D. L., 1112
Hyde, E. C., 874

Iekes, E. L., 1411
I.G. Farbenindustrie A.-G., 151, 159, 576, 577, 695, 698, 839, 975, 1199, 1245, 1405, 1493, 1505
Ihrig, H. K., 52, 216, 227, 228, 386, 762, 873, 1013, 1032
Illeman, R., 176
Imperial Chemical Industries Ltd., 433, 573, 603, 769, 839, 975, 1065, 1505, 1506, 1515
International Hydrogenation Patents Co., 151, 577, 695, 802, 1374, 1493, 1505
Ipatieff, V. N., 58, 74, 156, 237, 391, 674, 704, 769, 805, 914, 1043, 1045, 1047, 1048, 1049, 1068, 1291
Irauth, F., 161
Ireland, H. A., 1272
Isham, R. M., 156
Isom, E. W., 276, 1199
Israel, R. G., 1173
Ivanov, I. Z., 247
Ivanov, K. I., 246
Ivanova, E. G., 1166
Ivanovszky, L., 402, 546
Ivy, J. S., 633

Jachsel, J., 711
Jackson, T. H., 600
Jacob, P., 695
Jacobs, D. L., 694
Jacobsen, A. E., 681
Jakosky, J. J., 354, 638, 756, 1002
James, A. S., 125
Jamieson, J., 1097
Janssen, P., 76
Jasper, T. M., 25
Jellinek, H., 998
Jessen, F. W., 1164
Johnson, A. E., 368
Johnson, C. H., 849
Johnson, E. E., 1134
Johnson, E. W., 639
Johnson, F., 576, 707
Johnson, J. Y., 168, 315, 453, 603, 663, 716, 769, 802, 806, 839, 975, 1057, 1070, 1084, 1173, 1199, 1245, 1374, 1405, 1484, 1493
Johnson, R. E., 206
Johnson, S., 1217
Johnson, W., 810
Jones, A., 839
Jones, C. C., 463
Jones, C. L., 1217
Jones, D. G., 239, 1243
Jones, G. W., 73
Jones, L. D., 588, 707, 827, 945, 1505
Jones, P. H., 113
Jones, R. A., 632

Kadmer, E. H., 145
Kähr, H., 951
Kalantar, N., 1210
Kalichewsky, V. K., 423
Kallam, F. L., 1365
Kallos, K., 751
Kane, W. G., 98, 621
Kaplan, W., 1198
Karasev, I. P., 371
Karasik, M. M., 911
Karcher, J. C., 1119
Karzhain, W. A., 1354
Kashima, S., 1379
Kassel, L. S., 672
Katz, J., 548
Katz, K., 770
Kauffman, H. L., 460
Kaunart, P., 558
Kautter, C. T., 1095
Kay, W. B., 1474
Keiser, B., 664, 1177
Keith, P. C., 274, 429, 694, 1199, 1216
Kell, K., 600
Kellogg, C. M., 1217
Kellum, L. B., 629
Kelly, S. F., 998
Kemler, E., 1030, 1141
Kemp, L. C., 248
Kennedy, E. R., 886, 1165
Kennedy, R. E., 73
Kent, A. T., 769
Kenyon, T. S., 579
Keprianov, A. I., 390
Kerr, G., 67
Kerr, H. L., 1500
Kersanov, A. V., 288
Kesper, J. F., 65
Kessler, J. B. A., 611
Kettering, L. C., 1505
Keyte, W. R., 725
Khadzhinov, V. N., 244, 392
Kharasch, M. S., 229, 552
Kiersted, W., 944
Kimball, T. B., 1490
King, H. H., 230, 505
King, J. G., 159, 1097, 1220
Kingman, D. G., 1028
Kingston, B. M., 1136
Kirner, W. R., 263
Kiser, M., 79
Kiss, S. A., 415
Kistiakowsky, G. B., 541, 542, 779, 1046
Klabina, T. I., 275
Klas, H., 661
Klatt, R., 938
Kleinert, H., 712, 1234
Kleinpell, R. M., 326, 327
Klemgard, E. N., 824
Klinkman, G. H., 713
Klonnick, F., 1374
Knowles, E. C., 304, 1505
Kobuil'skaya, M. Y., 1335
Koch, H., 133
Koester, R. A., 3
Kok, W. J. C. de, 1167
Kölbel, H., 133
Kolomatzkii, D. Y., 435
Komarewsky, V. I., 391, 1043, 1048, 1049, 1291
Koppers Industrielle Mij., H., 537
Korduik, B., 733
Kornfeld, J. A., 1334
Kornfeld, J. H., 997
Kostrin, K. V., 820, 1179
Kothny, G. L., 750
Kovol'chuk, M., 1210
Kraft, W. W., 166, 1486
Krall, L. W., 1442
Krasilchik, A., 127
Krauch, C., 577
Krebs Pigment and Colour Corporation, 603
Krefft, O. T., 1405
Kriege, H. F., 82
Kroenig, W., 433, 1493
Krumbhaar, W., 698
Krupp A.-G., Fr., 151
Krutter, H. M., 1107
Kublo, Y. A., 308, 1393
Kudinov, A. V., 1241
Kudryavtsev, P. A., 427
Kuentzel, W. E., 806
Kühn, J., 1356
Kuhn, W. E., 248
Kung, J., 115
Kurtz, S. S., 295, 588
Kusner, T. S., 390
Kuznetsov, M. I., 353
Kuznetsova, A. N., 312
Kwal, B., 278, 808
Kyropoulos, S., 1209, 1389
Kyurkchan, A., 826

Lacey, W. N., 29, 130, 389, 393, 512, 538, 665, 875, 886, 1163, 1165, 1472
Lachman, A., 585, 1080
Lamb, J., 609
Lambert, P., 540
Lander, C. H., 1098
Lane, A. A., 1442
Lane, E. C., 51
Lane, E. K., 874
Lane, W. C., 5, 503, 643, 1289
Lane, W. G., 368
Lang, F., 582
Lang, W. E., 40
Langlehen, M. L., 364
Langlois, H. P. L., 1084
Langlois, H. N., 1084
Langton, A., 754
Larin, A. Y., 432
Larouche, —, 77
Larson, A. T., 156

Larsen, L., 810
Larson, L. A., 507
Lauer, B. E., 454, 1193
Laurent, R., 1223
Lavrovskii, K. P., 410
Layne, L. A., 114, 756
Lazar, A., 974
Leahy, M. J., 1171
Leathercock, C., 325
Leavesley, A. S., 1505
Lebendenko, —, 366
Le Blanc, O. de, 1442
Lecomte, J., 540
Lederer, E. R., 443
Lee, A. R., 450, 597, 962
Leendertse, J. J., 55, 59, 63, 775
Leet, R., 415
Legataki, T. W., 925, 1203
Legé, E. G. M., 704
Leib, C. H., 758
Leibo, A. N., 409
Leighton, P. A., 660
Le Mesurier, L. J., 1229
Lenker, S., 156
Leonardon, E. G., 482, 493
Leot, G., 1394
Lerch, W. B., 222, 372
Le Roi, E. J., 66
Lessing, R., 1256
Leupold, E., 467
Levin, H., 296
Levine, I. M., 694
Levine, M., 276
Levkopulo, N., 818
Levorsen, A. I., 10, 623, 732
Lewis, J. A., 1420
Lewis, W. K., 404, 443, 686, 694
Leyendecker, C., 1121
Liberthson, L., 939, 1217
Licence, A. B. C., 896
Lichtenheld, F. A., 518
Lichtl, —, 1076
Lichtz, L. C., 1375
Liddicoat, P., 1299
Lightfoot, J. H., 1164
Likhushin, K., 818
Limburg, H., 296
Lincoln, B. T., 1503
Lindeke, H. F., 707, 1505
Lindsly, B. E., 757
Lines, S. C., 526
Link, T. A., 1
Lisle, B. O., 531
Liston, J., 719
Livermore, G. P., 642
Livingstone, O. A., 1082
Livraghi, E., 704
Livshitz, S. E., 1335
Lobkov, A. M., 763
Loeb, H. D., 573
Loebel, A., 1201
Logan, K. H., 48, 1036, 1328
Logan, W. B., 418
Lohrengel, W., 426, 1077
Lorentzen, J., 979
Lorne, H. T., 1235
Lorraine, D. G., 1299
Loughrey, C. T., 577
Louis, M., 77, 1223
Love, F. H., 118, 525
Lovell, W. G., 1248, 1249
Loving, G. H., 350
Lowry, A., 679
Lowry, C. D., 700, 1258
Luca Muro, F. P. de, 990
Luckenrath, H., 746
Lugt, G. J., 1251
Luisenkova, E. S., 430
Lynch, T. L., 1134

Maass, W., 587, 823
MacClatchie, J. W., 868, 129
MacCubbin, A. A., 721
Macelwane, J. B., 745
Macgregor, J. R., 1088
Machin. App. Fabrik, 168
Machinerién en Apparatan Fabriker Meaf, N.V., 156
Machinskii, E. K., 365, 366
Mack, C., 170
Mackowski, L. L., 114
MacLean, G., 954
Macleod, D. B., 888
Macready, G. A., 756
Maillard, A., 1055
Mair, B. J., 387, 1218
Makkink, J. P., 775
Maksimovich, G., 1359
Malamphy, M. C., 743
Malishev, B. W., 430, 798, 1494
Malisoff, W. M., 259, 827, 1080, 1084
Mallyantz, A. A., 772, 1105
Mallison, A., 134, 299
Maluishek, V. T., 1105
Mandelbaum, M. R., 928
Mănescu, N., 984
Manley, R. E., 79, 418, 707, 827, 1084, 1500, 1505
Mann, C. A., 454, 1193
Manning, A. B., 448
Manning, S. E., 368
Maple, A. F., 1264
March, R. A., 17
Marder, M., 401
Marsene Corporation of America, 769
Marsh, L. E., 1245
Marshall, V. O., 903
Martens, J. H. C., 1262
Martiensson, O., 494
Martin, E. J., 1084
Martin, W. H., 720
Marvel, C. S., 57
Marx, A. H., 340
Mason, V. V., 24
Matthews, M. A., 433
Matthews, R. R., 294
Maur, B., 704
Maurel, A., 304
Maverick, G. M., 89
Maxwell, W. H., 756
Mayes, C., 1458
Mayes, H. B, 1332
Mayo, F., 68
Mayor, Y., 87
McAfee, A. M., 1217
McBee, E. T., 547, 1510
McBride, R. S., 617
McCarty, B. Y., 296, 443, 588, 944, 1084
McClintock, C. B., 511, 514
McCluer, W. B., 707, 1217, 1505
McCollum, B., 114
McConnell, T. A., 255
McCullough, G. W., 1031, 1156
McCullough, O. J., 114, 368
McCurry, J. R., 368
McFadden, E. D., 507
McGary, S. U., 1037
McGee, J. M., 585
McHatton, L. P., 148
McKay, C. R., 79
McKay, C. W., 1191
McKee, R. H., 769, 784
McKissick, W. H., 507
McMillan, W. A., 700, 1159, 1342
McNab, J. G., 239
McNab, M. C., 239
McNeil, C. P., 600, 1093
McNish, A. G., 1118
Mead, B., 290
Meaker, F. L., 412
Means, E. A., 895
Mears, W. H., 1046
Mekler, L. A., 276
Melberg, C. O., 1199
Mellersh-Jackson, L., 463, 1084
Memtzer, O. E., 864
Mendius, W., 297
Mercier, M., 624
Merrill, D. R., 588, 1084
Merritt, J. W., 106
Metallgesellschaft A.-G., 663
Metrot, M., 1223
Meusel, A., 128
Meyer, F. W., 1187
Meyer, G., 260, 1299
Meyer, K. N., 53
Meyer, W. H., 1418
Meyers, S. L., 646
Mezhebovskaya, E., 1385
Michaux, F. W., 858
Mickescu, J., 615
Middleton, W. W., 934
Migaux, L., 627
Migaux, M. L., 989
Mikesha, L. A., 1211
Miller, C. C., 1341
Miller, G. W., 1402
Miller, M. B., & Co., 827
Miller, S. P., 453, 847
Miller, W., 817
Mills, B., 20, 21, 191, 204, 212, 221, 336, 337, 355, 370, 502, 506, 643, 878, 990, 1003, 1004, 1009, 1019, 1026, 1114, 1148, 1426, 1446, 1447
Minshall, F. E., 1522
Minton, J. W., 334
Mitchell, J. G., 450, 962
Mitford, W. B., 801
Mizabe, N., 1117
Mock, F. C., 1250
Moisenko, V. M., 279
Moldavskii, B. O., 1335
Moll, F., 1094
Monakhova, V., 835
Mond, A. L., 76, 704
Montgomery, S. A., 600, 1505
Moore, A. D., 1160
Moore, H., 142
Moore, R. C., 96
Moore, W. F., 694
Moorman, A. R., 1084
Moravec, R., 156
Moresi, C. H., 329
Morgan, B. W., 72
Morgan, J. D., 830
Morgan, M. D., 264
Moritz, B. E., 1002
Mornhineg, A. R., 99
Morrell, J. C., 76, 265, 433, 585, 673, 694, 700, 701, 806, 812, 817, 839, 1080, 1208, 1378, 1492, 1494
Morris, A. B., 1023, 1025
Mortensen, R. A., 669
Moser, F. R., 585, 1500
Moss, C. O., 756
Mott, G. A., 463
Moyer, R. P., 296
Mudd, O. C., 47
Mukhin, L., 428
Müller, D. R. W., 1084
Mulligan, M. J., 675
Mummert, J. F., 756
Munteanu, M., 1199
Murphy, D. F., 1238
Murphy, G. B., 146, 445, 580, 887
Murphy, W. M., 1460
Muskat, M., 1448
Musselman, J. M., 79

Naphtali, M., 810
Naritimi, M., 19
Nash, A. W., 41, 68, 440, 945
National Aluminate Corpn., 1191
Nederbragt, G. W., 1388
Neely, G. L., 1480
Negreev, V. F., 1368
Nelson, E. F., 146, 694, 1194, 1195, 1371
Nelson, W. L., 692, 794, 919, 1202, 1364

Neptune, F. B., 924
Neudeck, J. E., 89
Neuhau, R., 384
Neumann, E., 1091
Newcome, R. B., 32, 1300
Newell, H. D., 571
Newman, A. B., 910
Newman, E. L., 995
Newport, C. L., 573
Newsom, J. B., 1437
Neymann, E., 161
Nicholson, F., 242
Nicholson, V., 593
Niederl, J. B., 1336
Niels, A. A., 874
Nieuwe Octrool Mij., N.V., 801
Nieuwland, J. A., 551, 776, 801, 1044, 1470, 1473
Non-Poisonous Gas Holding Co., 663
Nutt, D. B., 1208

O'Brien, J. W., 1440
Obryadchikov, S. N., 413, 1196, 1197
Ockrent, C., 1506
Ocon, E. A., 1199, 1402
O'Connor, D. L. T., 1134
Octroolen Maat. "Activit," N. V., 1515
O'Donnell, L., 101
Ofenbau Ges., 830
Ogg, R. A., 240
Oksenholt, J. N., 28
Olsen, N. S., 276
Olszewski, S., 331
O'Neill, F. E., 649
Oppenheim, V., 341, 1261
Opryshek, J., 1217
Orelup, J. W., 1245
Orlov, N. A., 247
Osgood, W. H., 36, 1021
Osterstrom, R. C., 1201
Ota, S., 446
Otis, H. C., 756, 1290, 1300
Otsuka, H., 1372
Overbaugh, W. V., 707, 1217
Owen, J. E., 639
Owen, W. H., 769

Padgett, F. W., 1217
Page, A. G., 412
Page, J. M., 1085, 1219
Palkin, S., 249
Parker, R. W., 43, 1325
Parkhomenko, V., 1212
Parkhurst, G. L., 588
Parks, G. S., 544, 668
Parks, W. G., 548
Parrish, C. I., 678
Parsons, C. P., 16, 1018
Parsons, L. G. B., 433
Patrick, R. E., 1140
Patterson, E. W., 756
Patterson, W. E., 1134
Paul, J., 756
Paul, W. H., 766
Paulus, M. G., 799
Pavlovskii, M. T., 397
Payne, C. R., 1080
Payne, D. E., 443
Payne, E. H., 1341
Pearce, S. J., 143
Pearl, W. A., 1410
Pearson, J. M., 528
Pease, R. N., 56
Pelzer, H. L., 414
Penick, A. J., 1134, 1299
Penick, K. T., 1134, 1299
Penniman, W. B. D., 1095
Pennington, J. V., 1290
Pérébaskine, M. V., 97
Perry, W. C., 384
Peski, A. J. van, 79
Peterkin, A. G., 414, 801
Peterman, L. S., 206
Peters, F. N., 1058
Peters, K., 388
Petersen, R. S., 801
Petetier, L. A., 403
Petrascheck, W., 854
Petroleum Processes Company, 1089
Pettit, O. W., 79
Petty, E., 296
Pevere, E. F., 1505
Pew, A. E., 72, 704, 1073
Pfau, G. M., 694
Pfeiffer, J. F., 955
Pfirrmann, T. W., 802
Pfund, A. H., 787
Phelps, M. W., 358
Philip, H. E., 649
Pichler, H., 132, 133
Pier, M., 433, 577, 695, 1066, 1492, 1493, 1505
Pigate, R. J. S., 117
Pilat, S., 1189
Pines, H., 58, 391, 805, 1043, 1045, 1047, 1049
Pinkley, G. R., 1270
Piotrowsky, W. de, 1401
Piper, J. D., 545
Pipik, O., 1385
Pirson, S. J., 31
Pitzer, M. B., 649
Planktokoll Chem. Fabrik, 168
Platz, H., 185
Plentl, A. A., 1338
Plisov, A. K., 1242
Plummer, F. B., 32
Plummer, W. D., 577
Pogue, J. E., 983
Pojarkova, A. I., 343
Polyakin, Y., 396
Polyakova, I. M., 232
Ponyatkov, —, 1360
Poole, J. M., 942
Poole, W. G., 684
Popov, S. N., 836
Post, E. S., 26, 107, 480, 519, 1132, 1176, 1271, 1280, 1451
Postlewaite, W. R., 756
Postovskii, I. V., 232
Potter, T. W., 296
Pott, A., 585
Potts, H. E., 415, 577, 695, 802, 913, 1200, 1245, 1374
Potts, W. M., 552
Pratt, D. D., 975
Pratt, O. G., 694
Precoul, M., 1408
Prescott, H. R., 1119, 1277
Prévost, E., 1227
Price, W. A., 335
Prickett, T. B., 1065
Priestly, W. J., 405
Proctor, A. C., 898
Prokhorova, Z. M., 284
Prokopetz, E. I., 244, 277
Pruitt, H. H., 694
Prutton, C. F., 1394
Puchkov, P. V., 410
Pummill, E. T., 274
Putnam, J. F., 529
Putnam, L. G., 475
Putschkow, P. W., 689
Pyzel, D., 694
Pyzel, E., 156

Quiggle, D., 431, 932, 1182

Rabinovich, E. I., 912
Rader, F. L., 590
Ragatz, E. G., 453, 704
Raggatt, H. G., 1259
Raikhlin, Y. R., 792, 793
Rall, H. T., 1337
Ralph, R. G., 223
Rapoport, I., 283
Rasmweiler, G. M., 978
Rather, J. B., 936, 1063
Ravenscroft, E. A., 1060
Ravikovich, A. M., 206, 308, 439
Rawlins, E. L., 1151, 1152
Raymond, E. F., 1442
Read, A. L., 1387
Reed, D. W., 189
Reed, H. S., 72
Reed, P., 1143, 1317, 1322
Reeves, J. R., 1263
Reginskaya, V., 1210
Reiber, F., 490
Reid, G. H., 975
Reinfeld, E. A., 1105
Reis, A., 817
Rembert, E. W., 801
Rendel, T. B., 1087
Renfrew, P. B., 1245
Renfro, J. C., 874
Renouil, Y., 164
Rescoria, A. R., 1348, 1469
Resinous Products Chemical Co., 443
Reuter, R., 817
Reynolds, J. H., 874
Rhodes, F. H., 1102
Rhodes, G. L., 42
Rice, O. K., 91
Richardson, J. O., 147
Rideal, E. K., 235, 697
Ridley, R. M., 756
Riedel, W., 596
Riemenschneider, E. W., 1084
Rilling, H. L., 1134
Ringer, F., 1066
Rinman, E. L., 1200
Rinsch, C. F., 923
Ritchie, A. V., 694, 790
Rittmeister, W., 415
Robbe, E., 162
Roberts, A. A., 169, 962
Roberts, C. H. M., 234
Roberts, D. E., 433
Roberts, J. K., 579, 694, 1066
Robertson, D. W., 681
Robertson, H. J., 1177
Robertson, L. B., 707, 1505
Robinson, B. H., 37
Robinson, J. F., 209
Rodionowa, K., 1424
Rodman, C. J., 1217
Roduta, F. L., 243
Rodzaevskaya, —, 310
Roe, R. M., 585
Roeder, C. H., 840
Roess, L. C., 1476
Rogers, F. M., 433
Rogers, J., 1312
Rogers, W. F., 46
Röhm & Haas Company, 1484
Rolfe, R. T., 684
Rosaire, E. E., 347
Rose, A., 1478
Rose, B. L., 453
Rose, F. W., 337
Rosenau, I. R., 1253
Ross, J. S., 1007, 1290
Rossini, F. D., 236
Rubichon, A., 735
Rubtzov, G. A., 903
Rudd, E. A., 1259
Rudenko, V. V., 287
Ruggles, J. P., 1268
Ruhoff, J. R., 541, 542
Ruhrchemie A.-G., 704, 817, 1208, 1484
Rumple, J. M., 537
Russo, M. J., 257
Rutherford, J. T., 290
Ruthruff, R. F., 579, 698, 1066, 1492
Ryder, H. M., 876
Ryder, H. W., 1316
Ryder, L. L., 57
Ryland, L. B., 261

Saaf, M. von, 1349
Saal, R. N. J., 596
Saatjian, K. N., 24
Sack, W., 1146
Sadakiyo, G., 1361
Sage, B. H., 29, 130, 389, 393, 512, 538, 667, 875, 886, 1163, 1165, 1472
Sage, C. E., 789
Sager, F., 1384
Saijo, S., 425
St. Clair, S., 723
Sanders, A. F., 1409
Sanders, T. P., 1131, 1286, 1292, 1303, 1310, 1315, 1425, 1428, 1454
Santillán, M., 476, 620
Sartain, W. M., 884
Saruchanoff, N., 69
Sato, M., 802
Sauter, V., 1374
Savinova, V. K., 246
Sawdon, W. A., 220, 362, 499, 749, 1124, 1137, 1278, 1432
Sawtelle, G., 852
Sawyer, T. K., 1127
Scantlebury, H. E., 1134
Schaphorst, W. F., 268, 271
Scheineman, F. W., 707
Schellhardt, M. A., 1151, 1152
Schenck, H. G., 326
Scherger, T. A., 843
Scheumann, W. M., 926, 1075
Schicktanz, S. T., 387, 1218
Schlesman, C. H., 297
Schlumberger, C., 114, 354
Schmalfeldt, H., 1386
Schmeling, F., 1511
Schmidlin, J., 682
Schmidt, E. F., 883, 1169
Schmidt, L., 383
Schmidt, W., 302
Schmitz, W. H., 600
Schnaebele, R., 727
Schneegans, D., 635
Schneegans, M. D., 14, 97
Schneider, H. F., 255
Schnidman, L., 1396
Scholtes, F. X., 1134
Schrenk, H. H., 143
Schneringer, F. N., 756
Schulze, G. A., 744
Schulze, W. A., 76, 290, 433, 585, 1080
Schwarz, R., 94
Schweitzer, P. H., 444
Schwers, F., 814
Schweyer, H. E., 452
Sclater, K. C., 367, 647, 755, 1126, 1281
Scott, B. H., 384
Scott, E. C., 753
Scott, F. L., 1134
Scott, G. N., 50
Scott, N. D., 1208
Searey, F. L., 1119
Seguy, J. D., 276, 694, 801, 1109
Seligman, A. M., 61
Sellards, E. H., 198
Separator Nobel, Aktiebolaget, 79, 588, 1304
Sequin, A., 1103
Serada, J., 131
Setkowicz, W., 141
Seto, I., 802
Sewell, J. L., 1072
Sharp, H. P., 869
Sharples Specialty Co., 827, 945, 1516
Shaw, S. F., 38, 39, 375, 652, 653, 1145, 1318
Shchitikov, V. K., 930
Shefstead, G. O., 276
Sheiman, A. B., 382
Shell Development Co., 1231
Shenfinkel, I. K., 837
Shephard, J. H., 1217
Sherborne, J. E., 538
Sherrill, M. L., 780, 781
Shevyakova, L., 283
Shik, V. N., 266
Shipp, V. L., 972
Shishchenko, R., 1144
Shkhiyan, S., 818
Shmuk, A. A., 833
Shrimpton, D. J., 1284
Shtaier, F. E., 279
Siebeneck, H., 1462
Sieder, E. N., 799
Sigwalt, R., 1221
Silakov, S. M., 570
Silent, R., 870
Simmons, A. C., 1314
Simon, W., 433, 695, 1066
Simons, O. F., 1080, 1505
Sinclair Refining Co., 168
Sinerez, J. de, 637
Singer, S. C., 1184
Singleton, J. C., 756
Siracusa, S., 1299
Sittel, V. J., 882
Skelton, W. E., 443, 588
Skin, W. L., 649
Skoblo, A., 826
Skowronski, F. J., 1208
Slagter, A. J., 1191
Slobodin, V. M., 280
Slomeger, J. C., 1311
Slooff, A., 220
Slotnick, M. M., 630
Slottman, G. V., 231
Small, J., 1520
Smiley, T. F., 420, 487, 651, 862, 863, 877, 985, 986
Smith, A. D., 694
Smith, A. K., 1394
Smith, A. I., 881
Smith, C. C., 545
Smith, C. L., 539, 694
Smith, E. R., 650, 1299
Smith, F. E., 813, 980
Smith, F. J., 889
Smith, G. H., 350
Smith, G. R., 478, 857
Smith, H. A., 541, 542
Smith, H. C., 573
Smith, H. G., 568
Smith, H. M., 156, 1337
Smith, H. W., 786
Smith, J., 1099
Smith, J. C., 368
Smith, J. H., 79
Smith, J. W., 1400
Smith, L. E., 483, 1453, 1485
Smith, L. I., 241
Smith, L. R., 1439
Smith, R. L., 1041, 1134
Smith, W. R., 779
Smoley, E. R., 166
Smull, J. G., 456
Snarskii, A., 200
Sneigr, D. S., 641, 1128, 1130, 1320, 1331, 1445
Snider, L. C., 333
Snoke, H. R., 1092
Snow, H. R., 276, 1505
Société de Prospection Électrique, 639
Société des Établ. Barbet, 433
Soc. D'Exploit. des Câbles Électriques Système Berthoud Borel et Cie., 1065
Société Française de Catalyse Generale, 716, 1173
Soday, F. J., 1513
Sokolov, W. A., 1106
Soll, A., 507
Solodovnik, M. A., 447
Sorokin, N. A., 382
Sorooa, H., 676
South, J. A., 1006
Southcombe, J. E., 400
South Metropolitan Gas Company, 415, 897, 1484
Sowa, F. J., 1044
Spain, E. L., 851, 1260
Spalding, J. D., 117, 507
Spang, F. J., 114
Sparks, W. J., 1084
Sparrow, S. W., 843
Speller, F. N., 23
Spencer, L., 756
Spicer, H. C., 472
Spieker, E. M., 1276
Squires, F., 1135
Squires, L., 1340
Stagner, B. A., 457
Standard Alcohol Company, 839
Standard Oil Company of California, 463
Standard Oil Company of Ohio, 443
Standard Oil Development Company, 79, 166, 588, 694, 707, 769, 817, 827, 1084, 1394 1505
Standinger, H., 975
Stanier, H., 514
Stansfield, R., 181, 807 841, 1229
Stapleton, V., 414
Stark, D. D., 1505
Starr, J. V., 79, 443
Starr, L. T., 1290
Statham, L., 639, 1119, 1277
Stearns, W. V., 1217
Steele, J., 840
Stehr, C. N., 234, 539
Steiner, L., 1053
Steiner, W. L., 1503
Steinrath, H., 661
Stellwaag, A., 710
Stephens, H. N., 243, 555
Stephenson, H. P., 992, 1067, 1173, 1515
Sterling Engine Company, 550
Sterrett, E., 179, 530, 1149, 1323
Stevens, A. H., 550, 716, 827
Stevens, D. R., 704, 1080
Stevens, H. F., 1134
Stevens, S. G. E., 789
Stewart, I., 1187
Still, A. C., 801
Still, C., 414
Stockman, L. P., 12, 363, 484, 1353, 1438, 1466
Stoll, F. R., 649
Stone, F. W., 1191
Stoops, W. N., 1477
Storch, H. H., 238
Storey, Le R. G., 1080, 1199
Stormont, D. H., 1403
Stout, W., 853
Strang, L. C., 568
Stratford, C. W., 159
Stratford, R. K., 588, 1217
Stratford, W. M., 72, 290, 433, 585, 1080
Strausser, P. W. C., 658
Streamline Filter Company, 588
Strevens, J. L., 708, 801, 940, 952
Streznyaki, G. J., 588
Strieter, O. G., 1092
Strigotzkii, A. A., 365
Strong, J. R., 1350
Stuart, A. T., 156
Studien und Verwertungsges. mit Beschränkter Hartung, 1357, 1484
Stueve, W. H., 1467
Sturtevant Engineering Company, 663
Suida, H., 163, 582
Suiva, T., 424
Suknarowski, S., 267
Sullivan, F. W., 72, 585, 698, 707, 1066
Sullivan, P. H., 1199

Sullivan, W. A., 1300
Susanov, Y. S., 902
Suslina, V. N., 288
Suslov, B. M., 965
Svenska Aktiebolaget Gas Accumulator, 69
Swallow, J., 1516
Swan, A., 318
Swanson, H. R., 153, 282
Swanson, P. F., 928
Swerinsen, H. T., 306
Swift, C. E., 588, 827
Swindell, F., 33, 196, 648, 903, 1035, 1133
Syabo, G., 28
Sylvania Industrial Corporation, 1506

Tamele, M. W., 261
Tarasov, B. K., 287
Tate, F. G. H., 894
Taylor, C. C., 1299
Taylor, F. B., 44, 205, 1034, 1125, 1138, 1321
Taylor, F. L., 241
Taylor, F. W., 117
Taylor, J., 1433
Taylor, J. F. M., 290
Taylor, J. L., 251
Taylor, J. S., 368
Taylor, J. W., 1442
Taylor, R. A. A., 448
Taylor, R. S., 456
Taylor, T. I., 810
Taylor, W. G., 1287
Tears, C. F., 1217
Teas, L. P., 193
Teichmuller, R., 733
Teis, K. R., 1006
Temme, T., 173
Terakopoff, R. G., 1080
Terry, J. B., 1351
Texaco Development Corporation, 168, 707, 827, 1394
Thayer, C. H., 412
Thayer, S., 49, 1329
Thomas, C. A., 1513
Thomas, C. C., 554
Thomas, C. R., 197
Thomas, D. E. F., 545
Thomas, H., 704
Thomas, H. D., 1430
Thomas, R. M., 1095
Thompson, A. E., 799
Thompson, D. D., 780
Thompson, J. K., 92
Thompson, J. L., 1168
Thompson, J. W., 226, 533
Thompson, S. A., 6
Thompson, W. N., 874
Thorn, S. D., 776
Thornycroft, O., 846
Thurston, R. R., 304
Tijmstra, S., 1394
Tikhinov-Dubrovksi, N. T., 791
Tikhomirova, M. M., 835
Tilbury, L. C., 874
Tiraspolsky, W., 731
Titeica, R., 1162
Titz, I. N., 159
Tobia, M., 395
Toby, E. M., 1514
Todd, S. S., 544, 668
Tokmanov, —, 310
Tongberg, C. O., 431, 932, 1182
Tops, J. L., 403
Towers, L. H., 35, 1301
Trask, P. D., 473, 725, 1265
Trautz, O. R., 1338
Traxler, R. I. V., 452
Traxler, R. N., 958, 1233
Tregubov, A. N., 258
Trescott, L. C., 680, 1398
Triggs, W. W., 769, 1245, 1405
Trimble, H. M., 147, 924
Troeller, W. J., 264
Tropsch, H., 554, 678
Trow, R. F., 276, 694
Trusty, A. W., 1395
Tschappat, L. P., 1442
Tsutsumi, S., 75
Tucker, M., 1282, 1298, 1427, 1465
Tucker, R. P., 714
Turechek, G. F., 874
Turkington, W., 756
Turner, E. E., 747
Turner, R. H., 273, 907, 908
Turner, S. D., 66
Turova-Polyak, M. B., 135
Tuttle, M. H., 79, 707
Twenhofel, W. H., 850

Ubbelohde, L., 253
Uhde, F., 802
Uljanov, A. W., 8
Ullrich, W., 418, 1500
Umpleby, J. B., 349
Underwood, A. J. V., 1065
Union Oil Company of Calif., 588
Universal Oil Products Co., 69, 151, 704

Valden, J. W., 1498
Vandenberg, G. B., 1238
Vanderbilt, B. M., 549
Vandover, J. R., 649
Varshavskii, S. L., 837
Varteressian, K. A., 1183
Vaughan, W. E., 541, 542
Veitch, F. P., 245
Veksler, Z. V., 427
Vermeulen, T., 667
Vetters, H., 1266
Vichnievsky, R., 1246
Vickers, R. N., 1134
View, C., 588, 982
Villars, D. S., 1492
Villers, A., 1299
Virobyantz, R. A., 427
Vivian, A. C., 657
Vlodrop, C. van, 63, 281
Vobech, A. C., 1500
Vogel, H., 1475
Vogt, C. J., 90
Vogt, R. R., 551, 801, 1473
Vokac, R., 81
Volck, W. H., 1217
Voorhees, V., 285, 1086
Vorizhtzov, N. N., 1236
Voronov, A. I., 308, 1393
Vose, R. S., 1505
Voznesenskii, A. A., 937

Wade, A., 323, 636, 861
Wagner, C. R., 153, 282, 920, 921, 1201
Wagner, H. W., 663
Wait, J. F., 433, 588, 1217, 1492
Walch, H., 827
Wales, J. A., 1199
Walker, C. L., 649
Walker, J., 934
Wallis, J. S., 412
Walter, G. F., 781
Walther, C., 557
Walther, H., 314, 595, 662, 959, 961
Walton, J. S., 811
Ward, J. J., 1506
Ward, J. T., 429, 1066
Warren, L. A., 894
Was, D. A., 291, 660
Wascheck, G., 1119
Waterman, H. I., 55, 59, 63, 281, 775, 1167
Watson, C. B., 694
Watson, C. W., 694
Watson, K. M., 146, 887, 1041
Watts, R. N., 586
Wayne, T. B., 1177
Webb, C. Z., 601
Weber, B. V., 344
Weber, G., 218, 1214, 1392
Weber, P., 547
Webster, D. C., 1163, 1472
Weckel, G. H., 1148
Wegrin, J., 1101
Weinzierl, J. F., 630
Weir, H. M., 1217
Weiss, H., 138
Wellard, R., 1042
Wells, A. A., 585
Wells, W. T., 368, 756
Wells, W. T., 649
Werner, C., 1139
Wert, S. N. van, 507
Werth, van der, —, 957
Westby, G. H., 352
Westen, H. A. van, 1167
Weston, C. B., 694
Westsmith, J. W., 1188
Wharton, A., 840
Wheeler, R. V., 92
Whitaker, C. N., 1496
White, A. R., 1245
White, G. D., 414
White, H. O., 1442
Whiteley, J. M., 296
Whitman, W. G., 694
Wickersham, H. P., 368, 756
Wickert, J. W., 839
Wiegrand, W. B., 1245
Wien, J. L., 887
Wiggins, W. R., 442, 773, 945
Wik, S. N., 715
Wilcox, J. A., 874
Wilder, N. M., 1024
Wilhelm, C. J., 383
Wilhelm, R. H., 784
Wilhelm, V. H., 1016
Wilkinson, C. J., 649
Williams, N., 71, 192, 229, 270, 741, 752, 1014, 1122, 1279, 1293, 1295, 1296, 1330, 1362, 1441
Williams, P., 296
Williams, V., 309
Wilmot & Cassidy Inc., 1095
Wilson, A. M., 1217
Wilson, C. H., 638
Wilson, C. W., 851, 1260
Wilson, D. M., 171, 398
Wilson, R. E., 72, 296, 588, 1216
Wilson, R. R., 1184
Wing, H. J., 459
Wingfoot Corporation, 603
Winkler, F., 156
Winkler, J., 1401
Winning, C., 1084, 1095
Winstein, S., 553
Winter, E. A., 769
Wintershall A.-G., 1386
Winzer, K., 388
Wirtel, A. F., 664, 1177
Wirth, C., 580, 1350
Withers, J. S., 827
Withrow, L., 978
Wood, A. M., 72
Wood, H., 1247
Wood, J. H., 45
Wood, N. E., 177
Woodall-Duckham Ltd., 769
Woodring, W. P., 327
Woods, G. M., 562, 964, 1071, 1206, 1502
Woods, H. B., 40
Woog, P., 1221
Wohlenberg, W. J., 1186
Wright, J. C., 368, 649, 756, 1299
Wunderly, H. L., 1044
Wyckoff, R. D., 1431
Wyszynski, O. V., 1421

Yalchnikova, E. A., 1294
Yamasaki, K., 446
Yancey, J. R., 1134
Yant, W. P., 143
Yarborough, H. C., 1442
Yeaw, J. S., 1396
Youker, M. P., 433, 573, 694, 769, 1208
Young, C. A., 551, 801, 1473
Young, F. R., 1468
Young, H. J., 88
Young, P. L., 1064
Young, W. C., 553
Yowell, O. P., 1290

Zaks, S. L., 382
Zapata, J., 592
Zarkhin, A. M., 702, 703
Zavertnik, J., 721
Zavoico, B. B., 481
Zeek, O. B., 114
Zeiber, B., 295
Zelinskii, N. D., 135, 159
Zel'tzburg, A. I., 1242
Zhirnova, L. V., 495
Ziegenhain, W. T., 699, 1285, 1291
Zil'berman, G. B., 1236
Zinchenko, K. E., 382
Zinner, K., 1397
Zlurys, E. J., 1375
Zobell, C. E., 471
Zorichak, J. J., 1452
Zuber, S., 9
Zublin, E. W., 1066, 1492
Zublin, J. A., 209
Zwerger, R. von, 116

ABSTRACTS SUBJECT INDEX.

Numbers refer to Abstract Numbers. (P) denotes Abstract of Patent Specification.

Absorption Oil, reclamation of (P), 1245
Abyssinia, petroleum policy of, 467
Acetone Peroxide, manufacture of (P), 716
Acid Oil, from alkali sludge, 838
Acid Sludge :
  acid recovery from, 290, 457, 1393
  analysis of, 267
  distillation of, 968
  dyes from (P), 603
  sulphur dioxide from (P), 537, 663
  use of, 1393
Acidity, Bukharov-Evstigeev method, 397
Acids :
  aliphatic, purification of (P), 975
  organic, manufacture of (P), 975
  synthetic, from paraffin wax, 312
A.E.C. Marine Oil Engine, 608
Africa, Equatorial, oil search in, 624
Albania, crude oil of, 416
Alberta :
  foothills structure, 1
  Turner Valley, developments in, 856
Alcohol Fuels :
  comparison with gasoline, 929
  corrosion by, 1204
  manufacture of, 809
  metal corrosion by, 426
  methanol, synthetic (P), 716, 1379, 1380
  methyl alcohol effect on, 1077, 1078
  miscibility of, 810
  tests on, 424, 425
  types of, 1377, 1378, 1381
  water value of, 1077, 1078
Alcohols :
  aliphatic, condensation of, with aromatics, 671
  dehydration of (P), 463
  ethyl, manufacture of (P), 839
  from cracked gases, 693
  from hydrogenation of carboxylic acids (P), 415
  from hydrogenation of fatty acids (P), 415
  methyl, purification (P), 1245
  *iso*propyl, manufacture of (P), 839
  purification of (P), 839
  sulphuric esters of, 603
  tertiary, manufacture of (P), 1405
Algeria, oil search in, 624
Alkali Sludge :
  acid oil from, 838
  caustic soda recovery, 902
  treatment of, 969
America, North, Palæozoic movements in, 96
Ammonia, nitrogen–hydrogen mixtures from (P), 769
Animal Oils, viscosity–temperature characteristics, 1469
Anti-Freeze Agent (P), 463
Argentina :
  Comodoro Rivadaira, faults of, 342
  crude oil of, 126
  geology of, stratigraphy, 1104
  National motor fuel, 421
  oil industry of, 187
  Pampa Amarillo, test well at, 1274
  petroleum, origin of, 987
  petroleum exploitation in, 987
    legislation in, 1412
    policy of, 467
  Soaneado, geology of, 108
  state control of oil industry, 188
Arkansas :
  geology of, 474
  oil prospects in, 339
  Snow Hill, geology of, 860
Asphalt :
  coatings on zinc, behaviour of, 959
  fluorescence of, 232
  light action on, 961
  oxidation of, 304
    (P), 600
  penetration–temperature relations of, 956
  production statistics, 302
  road, impact tests of, 81
  road, moving load tests on, 82
    physico-chemical aspects of, 170
    testing of, 80
  rock, uses of, 171
  suspensions of, consistency of, 1233
  temperature susceptibility of, 831
  Ur, analysis of, 589
Asphalt Paving Mixtures :
  physical properties of, 590
Asphalt–Rubber Mixtures, properties of, 599
Asphaltic Bitumen. *See* Bitumen.
Australia :
  Kimberleys, geology of, 636
  oil search in, 861
  western, geology of, 1259
Austria, oil exploration in, 15, 854, 1266

Bahrein Island, oil production in, 736
Bari-Sol Solvent Extraction Plant, 1213
Belgium, Antwerp refinery, 319
Benzole :
  analysis of, 1076
  aromatic content determination, 582
  desulphurization of, 556

Benzole—*cont.*
recovery of (P), 156
refinery of, 285
(P), 433
washing column for, 65
Bitumen, asphaltic :
absolute viscosity measurement, 83
adhesivity of, 300, 596, 597
adsorption of, by earths, 1235
coatings on zinc, behaviour of, 959, 960
colour testing of, 398
ductility determination, 591
fluidity factor test, 592
for fixing linoleum, 85
light action on, 961
manufacture of, 174, 305, 1508
(P), 176, 306, 453, 600, 1093, 1095, 1509
solvent extraction processes, 303
oxidation of, 304, 305
patent literature on, 957
penetration–temperature relations of, 956
plasticity of, 958
production statistics, 302
sulphur content effect, 593
temperature susceptibility of, 831
use in cold-room construction, 709
uses of, 172, 173
viscosity of, 955
viscosity–temperature characteristics, 452
weathering test for, 1092
Bitumen, Asphaltic–Rubber Mixtures, properties of, 599
Bitumen, cut-back :
adhesivity of, 1234
manufacture of, 954
Bitumen, paraffinic, uses of, 451
Bituminous Cement, fillers for, 84
Bituminous Materials, identification of, in mixtures, 1232
Bituminous Mixtures :
plasticity of, 958
testing of, mechanical, 1091
Boiling Point, Duhring equation modifications, 258
Borneo, drilling in, 19
Brazil :
geology of Devonian areas, 1261
Gondwana rocks of, 341
Sao Pedro, geophysical work in, 743
Brush Airless-Injection Engine, 465
Bukharov–Evstigeev Acidity Method, 397
Burner :
fuel oil, effect of fuel characteristics, 1399
gas (P), 69

California :
drilling practice in, 1278
geophysical work in, 863
Kern Co., geology of, 484
oil potentialities, 12, 1113, 1114, 1522
Palos Verdes hills, Miocene strata, 327
production methods in, 1137, 1278
California—*cont.*
Santa Fé, organic matter ratio to oil, 473
Venice and Del Rey, schist-bearing clastics of, 328
Canada :
Alberta. *See* Alberta.
Carbon :
activated, decolorizing power of, 1061
manufacture of (P), 839, 1515
Carbon Black :
from carbon monoxide, 1240
manufacture of (P), 178, 603, 1239, 1245, 1405
manufacture and use of, 966
Carbon Dioxide :
from natural gas, 1353
production of, from wells, 207
recovery of, from gases (P), 769
Carbonalpha, 1240
Carboxylic Acids, hydrogenation of (P), 415
Catalysts :
activity of, 548
carriers for (P), 923
Catalytic Reactions :
control of (P), 1065
gaseous (P), 663
Cathode-Ray Indicator, 181, 606, 717, 976, 1246, 1518
Cathode Ray Tubes :
equipment for, 399, 605, 718, 842
fluorescent screens in, 183
focusing of, 182
Ceresin, from zokerite, 307
Chile, petroleum exploration in, 994
China, oil prospects of, 103
Chlorex Solvent Extraction Process, 167
Chlorine, determination of, in organic compounds, 259
Coal :
cannel, carbonization of, 1097
constitution of, 1256
distillation of (P), 982
extraction of (P), 1258
hydrogenation of, 150
gasoline from, 278, 813, 814, 980
See also Hydrogenation.
low-temperature carbonization (P), 1099
Coalite process, 1255
Freeman process, 584
National Coke & Oil Co.'s process, 1098
oil from, cracking of, 149
Coal Dust, gasification of (P), 1386
Coal Oil :
cracking of, 149
diesel trials of, 708
Coal–Oil Mixtures :
carbonization of, 981
manufacture of, 948, 952
(P), 169, 830, 847, 982, 1516
solvents from (P), 982
utilization of, 448, 949
Coalite Low-Temperature Carbonization Process, 1255

Colloidal Fuel. *See* Coal–Oil Mixtures.
Colombia, petroleum statistics of, 619
Corrosion :
  anti-rust composition, 455
  by water and CO_2, 1192
  drill-pipe, 23
  inhibitors for, aliphatic amines as, 454
    aromatic amines as, 1193
  pipe-line. *See* Pipe-lines.
  protection against (P), 1065
    paints for, 659
    zinc and cadmium coatings for, 659
Cottonseed Oil, liquid fuels from, 1090
Cracking of Oil :
  carbon removal (P), 72, 801
  compared with coking, 692
  fuel oil, 953
  Iraq crude, 70
  kinetics of, 413
  New Forward process, 1198
  octane number calculations, 66
  operation of plant, 575
  plant for, 1188
    (P), 276, 414, 694, 801, 1191, 1199
    design of, 1196, 1491
    flow controller, 691
    lining of (P), 414
    reaction chambers, 1197
    temperature control, 574
  processes for, 1194, 1195, 1371
    (P), 72, 276, 414, 576, 694, 801, 1066, 1199, 1492
  recycle stock, 800
  reforming, latent heat of, 428
  Shukhov–Kapelyushnikov unit, 693
  T.V.P. process, 71
  two-stage unit, 911
  Uni-Coil Injection process, 1080
  vapour recovery, 703
  vapour-phase, kinetics of, 275
Crude Oil. *See* Petroleum.
Cut Backs. *See* Bitumen, cut-back.
Cutting Oil :
  sulphurized, 162
  water soluble, 963, 1212
Cylinder Oil, viscosity of, 822

Denmark, asphalt testing in, 80
Denoxol, 1401
Denoxol-Solve, 1401
Detektol O, 1401
Detonation :
  anti-knock action, 979
  elimination of, 464
  explosions in closed cylinders, 92
  flame photography, 978
  induction period in gaseous explosions, 91
  oxidation and combustion, 1042
  pressure rise rate, 1410
  speed of explosion wave, 1254
Dielectrics :
  fluorinated paraffin wax, 947
  liquid, 545
Diesel Oil. *See* Fuel Oil.
Disinfectant, manufacture of (P), 1245
Doctor Solution :
  lead determination, 1343
  regeneration of, 563, 1488
Dowtherm, physical properties of, 1180
Drilling :
  casing perforation, 650
  casing setting depth, 25
  circulation in, 499
    recovery of, 754, 870
  control of wild wells, 1441
  coring, cable-tool, 1123, 1124
  cost of, 1120
  deep, 1121, 1122
    problems of, 1005, 1291
  developments in, 355, 495, 1280–1282, 1436, 1446
  directional, 112, 208, 361, 500, 501, 749, 750, 871, 1127, 1128
  drilling-in in Oklahoma City, 1126
  fishing, photography as aid in, 1295
  fishing for stuck drill-pipe, 1014
  heaving shale problems, 26, 506, 647, 755, 1296
  in marshy areas, 20, 21
  large diameter wells, 1437
  method of (P), 874
  power for, butane engine, 1439
    efficiency of, 642
    electric, 111, 206, 359, 643, 1287–1289
    gas engine, 504
    steam, 358, 1283–1286
  pressure, 496, 869, 1006, 1007, 1009, 1290, 1435
  research on in U.S.S.R., 356
  rotary, 1010
    for CO_2, 207
  shooting of wells, 877
  speed influence on cost, 753
  surveying of wells, 112, 208, 361, 500, 641, 750, 871
  under water, 204, 1003
  water shut-off (P), 384, 1299
    injection method, 367, 516
Drilling Bits (P), 649, 1299
  brazing of, 360
  core (P), 368, 507, 649, 756
  detachable head (P), 1299
  gyratory (P), 209
  reamer (P), 368
  roller (P), 1299
  rotary (P), 649, 756, 1134, 1299
  welding of, 640
Drilling Equipment :
  anchor plug (P), 1299
  blow-out preventor (P), 1299
  boiler-feed arrangement, 357, 1125
  cable-tool, 22
  capping device (P), 28
  casing, long strings of, 362, 363
  casing cutter (P), 1134
  casing elevators (P), 209
    design of, 364
  casing head (P), 1134, 1299
  casing-head protector (P), 114
  casing joints, welded, 1012
  casing perforator (P), 649, 756, 1134

Drilling Equipment—*cont.*
casing protector (P), 1134
casing shoe (P), 649, 1299
casing spear (P), 114, 368
cementing (P), 209
chains, failures of, 502
cleaning-out tool (P), 368, 756, 874, 1134, 1299
collar breaker (P), 756
cooling system, water for, 1008
core barrel (P), 114, 1442
retriever (P), 28
core breaker (P), 209
corrosion of, 110
developments in, 319, 1280
draw-works brake (P), 114
drill-pipe (P), 114
corrosion protection, 23
development of, 865
drill-pipe protector (P), 649
fishing tool (P), 368, 1299
for drill-pipe, 1014
float valve (P), 114
formation tester (P), 368
inclinometer (P), 1134
jar (P), 114
liner support (P), 649
liner washer (P), 874
measuring line (P), 114
metals for, 866–868
mud pumps (P), 368
overshot (P), 368
packer (P), 114, 368, 507, 649, 756, 874, 1134, 1299
portable rotary, 1004, 1129
electric, 748
pressure tank door (P), 756
reamer (P), 28
reclamation of, 1438
rope socket (P), 874
rotary, 503, 1011
alloys for, 751
rotary drilling outfit (P), 368
steam, 1130
rotary jars (P), 368, 1299, 1442
sample-taker (P), 756, 1134, 1275
side-tracking tool (P), 28
stuffing box (P), 756
swivel (P), 507
tool joint (P), 649, 756, 1299
full-hole, 17
torpedo detonator (P), 114
travelling block (P), 1299
tubing anchor (P), 1299
tubing catcher (P), 507
tubing valve (P), 756
unitized, 1279
walking beam counterbalance (P), 114
well repair (P), 1134
whipstock (P), 874
packer (P), 114
wire lines, evaluation of, 24
failures of, 502
Drilling Mud. *See* Mud Fluid.
Drying Oils :
from gasoline, 837
from pyrolysed crude, 836
Drying Oils—*cont.*
manufacture of (P), 716
polymerized (P), 698
Duprene Rubber Substitute, 462

Earths :
activated, 566
adsorptive properties of, 280
decolorizing, 269, 796, 1185
decolorizing power of, 560, 797, 1061, 1487
spent, uses of, 460
Edwards Specific Gravity Balance, 248
Egypt, Suez refinery, 319
Emulsions :
bituminious, adhesivity of, 711
breaking of, 711–713
classification of, 710
for road construction, 301
manufacture of, 1400
patent literature on, 957
crude oil, prevention of, in wells, 223
separation of, 52, 222, 223, 1174–1176, 1359–1363, 1485
(P), 234, 539, 664, 1134, 1177
water measurement, 1150
tar, dehydration of (P), 690
water-in-oil (P), 443
Engines :
aero, carburetion research, 927
characteristics of, 1408
liquid cooled, 1247
anti-freeze agent for (P), 463
anti-rust composition for, 455
carbon deposits in, 1082
carburetion in, 1096, 1520
carburettors, deposits in, 89
freezing in, 318
cathode-ray indicator for, 181, 606, 717, 976, 1246, 1518
combustion in, 840, 841
compression-ignition, A.E.C. Marine, 608
120 h.p., 12-cyl. airless injection, 844
Brush airless-injection, 465
combustion chamber design, 1400
developments in, 610, 1519
exhaust deodorizer, 977
fuel adjustments of, 609
fuel injectors for, 1251
fuel spray photographs, 841
Hispano D.1., 466
operating costs, 317
problems of, 607
Ruston 7½ h.p. horizontal, 845
use on Netherlands railways, 1252
cooling of, water for, 1008
fuel gauge for, 1056
gas, cooling of, 762
extended expansion in, 180
internal-combustion, adjustment for volatile fuels, 1248–1250
bench testing of, 604
corrosion of, by butane, 1376
cylinder wear in, 88, 843
oil filter for, 179

Engines—*cont.*
internal combustion—*cont.*
operating costs of, 317
performance of, with gasoline and alcohol, 1375
supercharging of, 846
using butane–air mixtures, 90
natural-gas, combustion in, 719
oscillogram interpretation, 1517
Otto-cycle, infra-red radiation from, 840
Rolls-Royce Kestrel, 1247
Ether :
propyl, separation of (P), 716
*iso*propyl, as anti-detonant, 931
Europe, Palæozoic movements in, 96
Explosions, gas, alarm device, 536

Fatty Acids :
in benzine synthesis, 133
hydrogenation of (P), 415
Filter Acids, Hyflo-Supercel, 406
Fire Extinguishers, 1334
foam systems, 184
Firedamp, detection of, 1081
Fischer Process, in France, 702
Flame Propagation, temperature influence on, 316
Fluid Flow, through orifices, 115, 654, 656, 1168, 1481
Formaldehyde :
from cracked gases, 693, 835
manufacture of (P), 1095
France :
Fischer process in, 702
Gabian, geology of, 14
Gonfreville refinery, 319
Jura, oil search in, 1267
Martigues refinery, 319
National motor fuel, 421
Pechelbronn, oil horizons of, 190
oil reserves of, 727
Fuel Oil :
characteristics of, effect on burners on, 1399
cracking of, 953
diesel, 297
blended, S.I.T. of, 949
cetane rating of, 444
coal oil as, 708
coal-oil mixtures, 952
coal-tar oils as, 1397
cracked oils in, 828
ignition quality of, 444–446, 1088, 1228–1230, 1507
paraflow effect on pour point, 447
specification of, 829, 1226, 1227
testing of, 1225
distillation of, with soda, 1222
domestic, handling of, 1398
industrial, 950, 951
manufacture of (P), 169, 830, 1231
research on, 1221
stabilization of, 1223
Fuels :
combustion characteristics, 1395
competition in, 617
Fuels—*cont.*
flue products of, 1396
indigenous, prime movers for, 720
liquid, from coal, 1255–1257
solid, microchemical analysis of, 263
Fullers Earth, spent, uses for, 460

Gas :
explosion prevention, 73
liquefied, 767, 1376
sales of in U.S.A., 915
water, carburetted (P), 156
higher alcohols from, 284
Gases :
absorption of, by liquids, 666
carbon dioxide recovery from (P), 769
chemical reactions of (P), 663, 769
coal–water gas mixtures (P), 769
cracking, liquid products from, 768
desulphurization of, 1171
(P), 537, 663, 1173, 1357, 1484
determination of hydrogen and olefines in, 790
dust removal (P), 663, 769, 923
exhaust, analysis of, 815
composition of, 766
deodorizing of, 977
for steel cutting, 231
high-pressure properties of, 1041
hydrocarbon, fractionation of, 1342
industrial, oil recovery, 934
P.V.T. relationships of, 417
polymerization of, 62, 152–155, 282, 429, 803–805, 920–922, 1069
(P), 74, 156, 579, 698, 806, 923, 975, 1070, 1201, 1494
purification of, 917
(P), 769
refinery, pyrolysis of (P), 418
specific gravity determination, 248
stabilization of (P), 769
sulphur, toxicity of, 1059
sulphur dioxide recovery (P), 769
Gas Oil :
cracking of, 1089, 1372
hydroxy-acids from, 1242
manufacture of (P), 463
toluene from, 1241
Gasoline :
acid treatment of, 1496
(P), 159
alkali treatment of, 1206
anti-knock materials for, 924, 931
aromatics determination, 791
aviation, manufacture of, 158, 924
properties of, and carburetion, 927
chemical refining of, 701, 812, 933
clay treatment of, 928, 1205
colour stabilization, 936, 1063
comparison with alcohol blends, 929
with butane, 423
cracked, gum formation in, 700, 1385
octane number of, 66
peroxide estimation, 891
recovery of, 703

Gasoline—*cont.*
cracked—*cont.*
refining of, 287, 1382
(P), 76
stability of, 930
desulphurization of, 410, 580, 811, 1207, 1384
(P), 76, 159, 290, 433, 585, 704, 817, 1208, 1500
by hydrogenation, 689
with ozone, 288
distribution of, 121
doctor treatment of, 1207, 1383
evaporation losses, 122
from cannel coal, 1097
from coal hydrogenation, 278, 813, 814, 980
from coking of residues, 289
from ethylene polymerization, 914
from rubber hydrogenation (P), 159
gum inhibition (P), 704
hydrocarbon analysis of, 396
hypochlorite treatment of, 1495
lead response, 932
effect of sulphur, 807
lignite, refining of, 808
measurement of, in wagons, 765
Michigan, composition of, 431
natural, absorption plant for, 918
plant operation, 916, 918, 919, 1172, 1355
products from, 973
recovery of, 703, 916, 1062, 1497, 1498
stabilizer reflux for refrigeration, 1178
storage of, 1156
West Virginia, composition of, 431
Pennsylvania, composition of, 431
*iso*pentane addition to, 924
polymer, production of, 1499
polymers of, uses of, 432
refining of (P), 290, 433, 585, 704, 817, 935, 1080, 1202, 1208, 1500
phosphorus pentoxide for, 430
road tests on, 422
Rumanian, octane ratings of, 583
shale, heptane from, 247
solvent extraction of (P), 585, 1080
stability of, to light, 265
storage of, accidents in, 1157
sulphur determination, 1350
synthetic, from CO and H_2, 75, 283, 702
transport of, 125
vapour-pressure estimation, 147
volatility of, 925, 926, 1074, 1075, 1203
effect on engine design, 1248–1250
winter, properties of, 699
zinc chloride treatment, 564
Geophysical Surveying :
application in oil industry, 202, 203, 346–349, 740
electrical (P), 354, 1002, 1119
coring, 998
electric core-taker (P), 114, 494, 639, 756, 1002
electric coring in Gulf Coast, 482
Geophysical Surveying—*cont.*
from the air, 996
gas content determination, 200
geomagnetic co-ordinates, 1118
gravitational methods, 998
Haalck gravimeter, 109
magnetic methods, 998
principles of, 995
reflection system, 490
relation to salt domes, 201
resistivity, 638, 1001
relation to geological structure, 491
search coil method, 492
seismic, 744–746, 999, 1000
(P), 354, 639, 737, 1119, 1277, 1434
blasting caps for, 350
theory of, 351
seismic profile (P), 114
spontaneous polarization, 353, 998
structure mapping by, 1432
thermometric measurements, 493
(P), 639
torsion balance (P), 639
variometers, comparison of, 1116
Germany :
Bavaria, oil possibilities, 733
petroleum exploitation in, 988
synthetic motor fuel in, 816
Wietze–Steinförde, petroleum mining in, 1146
Glauconite, geology of, 95
Gray Clay Treating Process, 928
Great Britain, coal-oil production in, 1257, 1407
Greece, petroleum imports, 984
Gulf Coast :
electric logging in, 482
geology of, 191, 329, 1426
geophysical work in, 198, 199, 739, 741, 742
geophysics of, 345, 489
northern, petroleum reserves of, 1269
palæontological work in, 990
producing zone selection in, 480
salt domes, 852
plastic flow theory, 487
Shoestring, geology of, 630

Haalck Gravimeter, 109
Hispano D.1. Engine, 466
Hose, cargo, care of, 1033
Hungary :
geology of, 7
natural gas in, 7
Hydrocal, 1160
Hydrocarbons :
absorption spectra of, 1162
acetylene, condensation products of (P), 716
polymerization of (P), 159, 806
acetylene–ethane mixtures, 1159
aliphatic, viscosity of, 53
alkanes, molecular volume of, 543
alkenes, manufacture of (P), 603
alkylation of, 1049
*mono*alkylolamines (P), 1095

Hydrocarbons—*cont.*
anthracene, absorption spectra of, 540
hydrogenation of, 244, 392
aromatic, alkali metal addition products (P), 603, 839
alkylation of, 391
determination of, 791
benzene, chlorination of, 1236
depolyalkylation of, 1047
determination of, 143
hydrogenation of, 542
manufacture of (P), 975, 1484
nitration of, 784
oxidation of, 782
polymethyl, mercuration of, 241
benzine, synthesis of, 133
butadiene (P), 769
chlorinated, 462
reaction with bromine, 1158
butane, demand for, 420
Joule–Thomson coefficients of, 1165
specific heat of, 130
n-butane, decomposition of, 235
*iso*butane, heat of combustion of, 236
butane–air mixtures, compressibility of, 1164
butane–crystal oil mixtures, P.V.T. relationships of, 389
butanol-2, sulphuric acid action on, 245
butene mixtures, analysis of, 553
butene-2, isomerization of, 779
*iso*butenes, heat capacities of, 544
butylacetylene, reactions of, 551, 1473
*iso*butylene, hydrogen bromide addition to, 552
cholanthrene, 61
cyclic, from paraffin wax, 63
decalin, cracking of, 135
dialkylacetylenes, preparation of, 776
dienes, hydrogenation of, 542
recovery of (P), 315
diolefines, from olefines (P), 156
ethylene, ethyl chloride from (P), 975
hydration of, 670
polymerization of, 58, 238, 578, 914, 1068
ethylenic linkages, halogen addition to, 240
from natural gas pyrolysis, 1050
gaseous, chemical materials from, 1170
conversion of (P), 156
density of, 1474
polymerization of, 62
halogenated, refining of (P), 315, 975
heptane, from shale gasoline, 247
n-heptane, isomerization of, 550
*cyclo*hexane, alkylation of, 1048
*iso*hexane, 675
n-hexane, isomerization of, 1335
*cyclo*hexene, auto-oxidation of, 555
mesitylene, vapour pressure of, 672
methane, chlorination of, 390
detection of in atmosphere, 1081
fluoro-chloro derivatives of (P), 1515
Hydrocarbons—*cont.*
methane—*cont.*
from CO_2, 128
solubility in petroleum, 665, 1472
thermodynamic properties of, 1471
methane–hydrogen mixtures, CO determination, 260
methane–petroleum mixtures, specific volume and specific heats of, 1163
methyl acetylene, hydrogen bromide addition to, 239
2-methylbutene-1, preparation and properties of, 781
Raman spectra of, 780
2-methylbutene-2, Raman spectra of, 780
methyl*cyclo*hexane, combustion of, 246
methyl nonanes, 676
n-octane, isomerization of, 1335
iso-octane, preparation of, 668
olefine–benzene condensation, 1044, 1045
olefines, condensation products of, 1405
determination of, 790
esters from (P), 463
hydration of (P), 769, 1405
hydrogenation of, 541
motor fuel from (P), 74, 76
oxides (P), 716
polymerization of, 152–155, 281, 920–921
(P), 74, 156, 579, 698, 806, 923, 975, 1070, 1201, 1494
production of (P), 156, 1173
pyrolysis of, 678
reaction with sulphur dioxide, 57
sulphuric esters of (P), 1095
oxidation of, 1401
P.V.T. data, application of, 404
paraffin, acetylene from (P), 663
alkylation of, 237, 1043
aluminium chloride action on, 674
boiling points of, 129
chlorination of, 547
gaseous, nitration of, 549
gaseous, pyrolysis of, 554
thermal cleavage of, 388
*cyclo*pentadiene, detection of, 262
kinetics of, 1046
pentane, Joule–Thomson coefficients of, 1165
*iso*pentane, as anti-detonant, 924
2-pentene, polymerization of, 59
pentenes, 677
perpylene, manufacture of (P), 839
phenanthrene, synthesis of, 60
polymerization products (P), 975
propane, boiling and freezing point of, 774
decomposition of, 235
Joule–Thomson coefficient of, 886
oxidation of, 56
specific heat of, 130
*cyclo*propane, preparation and properties of, 778
Raman spectra of, 777
synthesis of, 1510

Hydrocarbons—*cont.*
propane–butane mixtures, specific heats of, 667
propane–pentane mixtures, specific heats of, 667
propylene, polymerization of, 679, 805
preparation and properties of, 778
propylene oxide (P), 1173
saturated, oxidation of, 54
olefines from (P), 1173
stability of, to light, 673
synthetic, composition determination, 55
conversion of, 132
tertiary, oxidation of, 243
toluene, combustion of, 246
from gas oil, 1241
oxidation of, 548
thiophene removal, 798
unsaturated, determination of, 1167
hydration of (P), 156
polymerization of (P), 698, 806
polymers of, physical constants, 775
thiocyanate action on, 127
vapour pressures of, 885
viscosities of, high temperature, 887
viscosity–temperature relationships, 773
xylenes, vapour pressure of, 672
Hydrogen :
determination of, 790
manufacture of (P), 1200
Hydrogen–methane Mixtures, CO determination, 260
Hydrogenation :
catalyst (P), 577
molybdenum sulphide, 277
hydrocarbon oils, 1373
plant for (P), 151, 415, 802, 1374
processes for (P), 151, 415, 433, 577, 588, 695, 802, 913, 982, 1067, 1200, 1374, 1493
rubber (P), 159
with pyrolysis, 912
Hydroxy Acids, from gas oil, 1242
Hyflo-Supercel Filter Aid, 406

Insecticides :
lubricants as, 601
manufacture of (P), 1405
oil sprays, toxicity of, 714, 1238
tar and petroleum oils for, 86
Insulating Oil :
acidity determination, 1346
breakdown strength of, 666
composition and conductivity, 1390
corrosion of metals by, 660
deterioration of, metals effect on, 291
gas generation by electric discharge, 1388
oxidation measurement, 1479
properties of, 1387
Iodine :
from underground water, 833, 965
separation from solutions, 834
Iran, Naft-i-Shah refinery, 319
Iraq :
crude oil, cracking of, 70
pipe-line, 879
Italy, petroleum policy of, 468

Japan :
petroleum industry of, 93
synthetic fuels in, 1079
Jugo-Slavia, petroleum in, 1523

Kansas :
geology of, 3
Oxford, crude oil of, 233
western, geology of, 197
Kauri-Butanol Test, 264
Kerosine :
as weed killer, 602
colour stabilization, 936, 1063
cracked, as tractor fuel, 427
desulphurization of, 410, 562
hydrogenation of, 1373
manufacture of (P), 463
oxidation of, 938
smoke-point determination, 1351
sulphonation of, 818, 937
Ketones, dehydration of (P), 463
Knock-Rating :
allowable boost ratio method, 403
C.F.R. method, 1087
lead response, effect of sulphur, 807
octane number and S.I.T. relationship, 1253
octane scale, nature of, 157
relation to test engine, 401
Kravtzov Tube Still, 1179

Laboratory Apparatus :
absorption of gases by liquids, 666
absorption tubes, weighing of, 1336
acidity determination, 397, 1346
bubble-cap column, 893
carbon dioxide determination, 895
colorimeters, 402, 546
combustion, 1344
corrosion, copper strip cleaning, 1166
counter-current treatment, 142
critical temperature and pressure determination, 1476
dissolving asphalt deposits, 1055
distillation, 892, 1478
(P), 682, 897
vacuum, 142
evaporation rate determination, 715
fluorescence measurement, 1054
friction testing, 400, 1347
gas acidity determination (P), 897
gas fractionation, 1342
hydrocal, 1160
hydrocarbon analysis, 396
hydrogen-ion determination, 1345
melting-point determination, 257
micromanometer, 786
molecular weight determination, 1338
oil gauge, 249, 1056

Laboratory Apparatus—*cont.*
photometers, 402, 546
separation of liquids (P), 1057
smoke point, 1351
specific gravity balance, 248
surface tension, 787
thermostat, 788
vapour-pressure slide rule, 889
viscometers. *See* Viscometers.
water determination, 894
Lacquers, nitrocellulose, 715
Land, value estimation, 1411
Lead Tetra-alkyl, manufacture of (P), 1245, 1405
Lead Tetramethyl, photolysis of, 669
Lead Tetraphenyl, photolysis of, 669
Leather Oils, 461
Liban, petroleum exploration in, 1108
Lignite Oil, as motor fuel, 286
Linseed Oil, oxidation of, 456
Louisiana :
Cote Blanche salt dome, 330
Jefferson Island salt dome, 101
Jennings salt dome, 105
North, geophysical work in, 1433
petroleum stratigraphy of, 631, 1416
Rodessa, crude oil of, 233
drilling problems in, 752, 1440
geology of, 337–339, 633, 1427
Tepetate, geology of, 192
Lubricants :
acid treatment of, 292
ageing of, 163
as insecticides, 601
asphalt removal (P), 168
chemical constitution of, 387, 1211
chlorine addition to, 1503
colour measurement, 1482
composition and conductivity, 1390
crankcase, dope for, 160
deasphaltizing of, 944
dewaxing of (P), 79, 168, 296, 443, 588, 707, 827, 945, 1084, 1217, 1394, 1505
solvent processes, 166, 943, 944, 1213, 1392
diesel engine, dilution of, 77
diluted, viscosity of, 137
doped, road tests on, 434
extreme-pressure, testing of, 436, 1480
film strength of, 145
flange oil (P), 296
fluorescence measurement, 1054
production (P), 168, 1095
fractionation of, 826
friction testing, 400, 1347
from rubber hydrogenation (P), 159
gas generation by electric discharge, 1388
graphitic, 1083
greases, 294, 587, 823
lime-soap (P), 79
service tests of, 824
stability of, 438
structure of, 706
load-carrying capacity of, 145
manufacture of, 567, 1391
Lubricants—*cont.*
manufacture of (P), 79, 168, 296, 443, 463, 588, 707, 827, 945, 1084, 1217, 1394, 1505
mixed, viscosity of, 137
neutralization of, 820
oiliness of, 1209, 1389
index of, 939
oxidation of, 940
pour-point reduction (P), 296
pseudo-plasticity of, 138
solvent extraction. *See* Solvent Extraction.
solvent-refined, characteristics of, 441
comparison with other oils, 435
specification of, 825
used, dissolving asphalt deposits, 1055
iron determination, 1348
reclamation of, 164, 165, 586, 941 (P), 79, 296, 588, 945, 1084
viscosity of, 138, 139, 557, 822
viscosity–temperature relationships, 773
volatility of, 437
voltolization of, 1502
wetting capacity of, 161
Lubrication :
mechanism of, 436
metallic wear and, 705, 821
piston ring, 1501
problems of, 825
pump, 530

Madagascar, oil search in, 624
Manchukuo, petroleum industry of, 93
Marschalko Viscometer, 83
Measurement of Gas :
alignment chart for, 1458
meter delivery chart, 1155
problems of, 1031, 1321
Measurement of Oil :
field tanks, 221
in tank wagons, 765
individual wells, 220
orifice meters for, 1015
weight *vs.* volume, 185
Mercaptans, determination of, 261
Metal Halides, reactions of, 1470
Metals :
alloys, hydrogen-resistant, 151
corrosion of, by insulating oils, 660
corrosion-resisting alloys, welding of, 405
painted, corrosion behaviour of, 1369
steel, hydrogen effect on, 1367
Mexico :
geology of, 476, 620
north-east, Eocene geology of, 98
palæogeography of, 629
structural geology of, 721
Tampico, micropalæontology of, 622
Michigan :
Crystal Pool, geology of, 1273
new fields in, 1428
Mississippi, fauna of Vicksburg group, 99
Mississippi Delta, drilling in, 20

Molecular Weight :
microvapormetric determination of, 1338
nomographs for, 890
petroleum fractions, 1337
Morocco, oil search in, 624–628, 989
Motor Fuels :
alcohol. *See* Alcohol Fuels.
butane as, 1376
butane and gasoline compared, 423
from coal, 1255–1257
from coal extraction (P), 1258
from cottonseed oil, 1090
gas as, 581
lignite oil as, 286
manufacture of (P), 159, 433, 585, 704, 817, 1080
national, 421
polymer benzine, 419
synthetic, 814, 816
See also Alcohol Fuels, Gasoline.
Mud Fluid :
characteristics of, 497
chemical treatment of, 23
circulating system for, 644
conditioning of, 1298
control of, 498, 499, 1440
evaluation of, 113, 870
fibrous materials in, 16, 754, 1013
gel type, 1133
hot, handling of, 872
properties of, 1297
removal of, from wells (P), 649
types of, 645
viscosity characteristics of, 18
Multi-Sol Solvent Extraction Plant, 1214

Naphthenic Acids :
driers from, 458
from petroleum, 87, 972
use as preservative, 971
uses of, 972
Naphthiol, preservative, 971
National Coke & Oil Co.'s Carbonization Process, 1098
Natural Gas :
as selective solvent, 819
carbon dioxide from, 1353
carbon monoxide and hydrogen from, 1354
chemical materials from, 1170
desulphurization of, 1171
for reduction of copper oxide, 1356
gasoline from (P), 433
Hungary, 7
hydrocarbons from, 1050
measurement of, 1031, 1155, 1321
of tin dioxide, 1356
polymerization of, 803, 804
products from, 973
pyrolysis of (P), 418
underground storage of, 381
use in central power stations, 1169
Natural Gas-Petroleum Mixtures :
thermodynamic properties of, 393
volume and viscosity studies, 875
Nebraska, geology of, 1429
Netherlands, use of C.I. engines on railways, 1252
Netherlands East Indies, Tempino to Pladjoe pipe-line, 225
New Forward Cracking Process, 1198
New Mexico, Lea County, water supply, 27
Nomenclature, petroleum, 94

Ohio, oil source material in, 853
Oil Sands :
oil flow in, 1022
permeability of, 876
saturation of, 515
texture of, 862
volume and void volume determination, 517
volumetric studies of petroleum-gas mixtures, 875
Oil Shale, products from, in Scotland, 1406
Oklahoma :
Coal Co., geology of, 991
Crescent, geology of, 992
Fitts Pool, geology of, 1112
Fox Pool, geology of, 11
geology of, 474
McAlester Basin, geology of, 195
McCurtain Co., geology of, 634
Moore, geology of, 992
Oklahoma City, drilling-in in, 1126
production methods, 518
Olmugee Co., geophysical work in, 352
Osage Co., Chattanooga shale, 325
Seminole, geology of, 993
southern, geology of, 196
Talco fault zone, 857
water flooding in, 35
Organic Compounds, chlorine determination, 259
manufacture of (P), 839, 1405
Origin of Oil, 470, 725, 853, 987, 1424
Ostwald Viscometer, modified, 1052, 1339
Ozokerite, treatment of, 307
Ozone :
as oxidation catalyst, 54
for desulphurizing gasoline, 288

Page Impact Machine, 81
Paints :
aluminium-tar, 313
anti-corrosive, 1244, 1370
bituminous, 314, 595
air-drying, 175
for corrosion protection, 659, 662
insulating varnishes, 1404
petroleum solvents for, 1514
reaction to zinc surfaces, 459
thixotropy of, 1483
two-coat systems, 681
water-resistance determination, 148
Palestine, geology of, 1109

Paper, impregnated, manufacture of, 594
oil viscosity determination, 255
Paraffin :
liquid, bromination of, 394
chlorination of, 394
gas generation by electric discharge, 1388
power factors and conductivity of, 545
sulphuric acid test for, 789
Paraffin Wax :
acid derivatives of (P), 1506
chlorination of (P), 1506
composition of, 1218
and conductivity of, 1390
cyclic compounds from, 63
esters of (P), 1506
fluorinated, 947
manufacture of, 308, 946
(P), 1219, 1506
paraffin wax determination, 266
refractive index of, 1085
solvent separation of (P), 1086
sweating of, 449
(P), 1086
synthetic acids from, 312
Paraguay, geology of Devonian areas, 1261
Patagonia, geology of, 97
Pennsylvania :
Farmington gas field, geology of, 1425
Hebron gas field, geology of, 1263
Oriskany sand, oil in, 1268
Peroxides, manufacture of (P), 716
Petroleum :
Albanian, 416
Argentina, analyses of, 126
" base " of, 51
desalting of, 1366
dissolved gas effect on viscosity, 538
distillation of (P), 412, 539
evaluation of, 680
fluorescence of, 232
gas solubility in, 665
Oxford, Kansas, analyses of, 233
Poland, analysis of, 770
prices of, 983
researches on, in antiquity, 1103
Rodessa, La., analyses of, 233
sulphur compounds in, 783
Talco, Texas, analysis of, 1358
Petroleum Coke, uses of, 1243
Petroleum Fractions :
characterization of, 146
extraction of (P), 433
Petroleum Geology :
advances in U.S.A., 623
aerial surveying, 1264, 1417, 1418
bacteria in marine sediments, 471
continental spreading, 323
core analyses, 728, 729, 1420
correlation, use of insoluble residues for, 1272
deformation of earth's crust, 1117
dip determination, 849
dome structures, 324
edge water significance, 8
Petroleum Geology—*cont.*
gas exploration, 1106
marine unconformities, 850
Mediterranean type deposits, 9
migration and accumulation, 10
oil horizons, detection of, 190
organic matter ratio to oil, 473
origin and tectonics of salt and oil terrains, 486
origin of oil, 470, 725, 853, 1265
permeability, calculation of, 1107
of sands, 730, 1419
radio transmission and, 1276
reservoir characteristics, 485, 731, 732
formation, 483
rock temperatures and depths in U.S.A., 472
salt domes, geophysics relation to, 201
plastic flow theory, 487
sand thickness maps, 986
Tertiary series, Refugian stage, 326
underground pressures, 724
relation to depth, 985
underground temperatures, 724
relation to depth, 985
underground water, hydrology of, 864
Petroleum Industry, world crisis and, 611
Petroleum Jelly, refining of, 310
Petroleum–Methane Mixtures, specific volume and specific heats of, 1163
Petroleum–Natural Gas Mixtures :
thermodynamic properties of, 393
volume and viscosity studies, 875
Petroleum Soap, manufacture of, 311
Phenols :
identification of, 242
recovery of (P), 1245, 1405
Phosphorus Pentoxide, for refining gasoline, 430
Pipe-lines :
air survey for, 1459
coating of, 1332
tester for, 881, 1461, 1462
with concrete, 526
construction of, 1460, 1467, 1468
corrosion of, 529, 880, 1035, 1036, 1328
electrolysis measurements, 528
corrosion protection, 42, 43, 46–50, 120, 525, 661, 882, 883, 1037, 1038, 1329–1331
design of, slide rule for, 41
fabrics for, deterioration of, 50
fluid flow in, 656
gas, 1154
blow-off protector, 884
losses in, 43
prime movers for, 1325
reconditioning of, 1326
gasoline, 230, 1467, 1468
Iraq, 879
manifolds, operation of, 1034
operation of, 1466
pump for, 1322
lubrication of, 530
pumping in, power for, 228, 764
reconditioning of, 42, 229, 1463, 1465
repair of, by welding, 527

Pipe-lines—*cont.*
river crossings, 44
Tempino to Pladjoe, N.E.I., 225
U.S.S.R., 1039
wax removal, 45, 118, 227
welding of, 657, 1327, 1464
Pitch, coal-tar, light action on, 961
Poland :
crude oil, analysis of, 770
exploratory work in, 1421
oil and gas shows in, 331
oil industry of, 722, 1413
Polymerization, 62, 152–155, 282, 429, 803–805, 920–922, 1068, 1069
adsorptive properties of silicates, 280
catalyst and inhibitor effects, 697
costs of, 155
kinetics of, 696, 697
processes for (P), 74, 156, 579, 698, 806, 923, 975, 1070, 1201, 1494
Portuguese East Africa, oil prospects of, 475
Production Apparatus :
acid introduction (P), 40
boiler (P), 756, 874, 1299
bottom-hole choke, 1309
control head (P), 117
corrosion of, 1018
flow beans, use of, 1449
flow regulator (P), 649, 1299
formation tester (P), 649, 874
gas bean (P), 756
gas lift, 376, 377
pump combined, 1029
gas tank closure (P), 40
gas trap, 33
heater for wells (P), 649, 874
plunger lift (P), 40, 224, 384, 756, 1442
pump (P), 40, 756, 874, 1134, 1442
pump anchor (P), 1134
pumps, bleeder for (P), 1299
casing, 213
electric (P), 507
pneumatic, 378
submergible, 522
pump-gas lift combined, 1029
pump plunger (P), 384
pumping, 1313
(P), 117
for prorated wells, 520
gas engines for, 1028
power for, electric, 1450
pumping jack, 1451
pumping power, 519
pumping rod assembly (P), 1134
repressuring (P), 40
screen pipe (P), 368, 1134
screens, cleaning of, 1443
sucker rods, failure of, 523, 760
life of, 1030
Production of Natural Gas, well characteristics, 1151, 1152
Production of Oil :
acid treatment of wells, 32, 372, 373, 509, 1017, 1018, 1135, 1136, 1300, 1301
chokes, size determination, 370
Production of Oil—*cont.*
controlling conditions of, 371
decline curves of wells, 31
developments in, 369, 1016, 1281, 1302, 1446, 1447
economics of, 758
energy relations in, 29, 757
flow of oil in rocks, 1022
flow of oil-gas mixtures in tubing, 512
flow string setting, 1131
flow through orifices, 115, 654
flowing (P), 649, 1299
free water separation, 655
gas conservation, 1153
gas disposal, 1149
gas extractor for, 1306
gas lift, 38, 39, 375–377, 651–653, 763, 1144, 1145, 1318–1319
(P), 384
pumping combined, 215
gasification in situ, 382
heavy oil problems, 1305
high-pressure wells, control of, 1307, 1308
Hughes plunger lift, 116
metering of wells, 220, 654
methods of, 521
(P), 649
mining, 1146
oil-gas separation, 524
paraffin removal, 216, 1147, 1148
plunger lift, 116
porosity of limestone, 30
pressure maintenance, 878
pumping :
back-side crank, 1027
counterbalances for, 1141
deep wells, 1137, 1310
dynamometer for, 1139
cards of, 1138, 1311
economics of, 37
electric power for, 1140
group, 761
hydraulic power for, 210
(P), 649
pneumatic, 214
slanted wells, 212
pumping-gas lift combined, 215
repressuring, 217–219, 379, 380, 510, 511, 876, 1017, 1024, 1026, 1306
compressor problems, 1312
gas injection, 217
reserves, estimation of, 726, 727, 1456, 1457
Schweiger plunger lift, 116
shooting, effect of, 877
stage lift (P), 384
subsurface pressure gauge, 513
subsurface pressure records, 36, 1021
twin wells for separate horizons, 1303
water control, 1452
water disposal, 383, 505, 648, 873, 1032
water flooding, 34, 35, 211, 508, 514, 759, 1017, 1023, 1025, 1142, 1143, 1314–1317, 1453–1455
well productivity, index for, 1020, 1448
well spacing and, 1304

Pumping Stations :
D.C. generators for, 764
electric power for, 1324
operation of, 1323
Pyrolysis, with hydrogenation, 912
Pyrometer, for bottom-hole temperatures, 5

Quartz Lamp, use in oil analysis, 144
Quenching Oils, 177

Refineries, Port Isabel, Texas, 1072
Refinery Plant :
acid treatment (P), 274
Alco units, increasing capacity of, 565
alloys for, 571, 1064
aluminium for, 572
centrifuge, 1190
(P), 827, 1394
clay treatment (P), 1084
control instruments, 898
corrosion of, 570, 1192, 1368
corrosion prevention (P), 1191
counter-current extraction, 1183
counter-current washer (P), 663
desalting unit, 1366
developments in, 319
distillation (P), 690, 799, 1486
vacuum, 687
distillation-cracking unit, 270
feed-water heater, 271
fractionation (P), 412, 573, 690, 799, 1065, 1191
fractionation columns, design of, 68, 568, 795, 1182, 1184
furnaces, 409
(P), 412, 573, 1065, 1191, 1490
flue gas losses, 268
radiation reaction, 1186
temperature measurement, 1187
gasoline, construction and operation of, 916
heat exchangers, design of, 903, 904, 907, 909
economics of, 272, 1364
equations for, 905, 906
selection of, 273
thermodynamics of, 908
heat insulation, 1181
heating coils (P), 274
Kravtzov tube still, 1179
modernization of, economics of, 1365
pipe flanges, 569
pipe heater (P), 69
pipe joint for high pressure, 411
pressure vessels, welding of, 683
stabilizer, 688
steel, hydrogen effect on, 1367
stills, lining for (P), 573
temperature regulator, 1191
tube still (P), 412
washing columns, 933
wax-sweating stove (P), 79
Refining of Oil :
acid treatment, 1071
Refining of Oil—*cont.*
ammonia for, 1489
caustic treatment, 771
chemical trends in, 408
coking, compared with cracking, 692
costing of, 67
decolorization, silicic acid for, 796
desulphurization, bacteriological, 772
carbon monoxide for, 798
distillation, 685
(P), 412, 539, 1191
filtration, Hyflo-Supercel in, 406
fractionation, analysis of, 826
(P), 412
flow control, 686
health risks in, 1059
heat transfer coefficients, 1180
laboratory tests, 680
oxidation (P), 1095
P.V.T. data application, 404
Sam Fordyce, Texas, crude, 1072
steam and heat costs, 794
topping, chemical (P), 1073
wastes in, 901
Refrigeration, use of stabilizer reflux, 1178
Residues :
asphaltic, saponification number determination, 1352
coking of, 289
fractionation of, with gas, 819, 1189
Resins :
from mineral oil (P), 463
synthetic, properties of, 1477, 1512, 1513
Rheology. *See* Viscometry.
Road Construction :
emulsions for, 301
machinery for, 298
Roads, slipperiness of, laboratory tests, 598
Rolls-Royce Kestrel Engine, 1247
Rubber, hydrogenation of (P), 159
Rubber–Coal Tar Mixture, manufacture of (P), 975
Rubber Substitute :
chlorinated butadiene, 462
polymerized products as (P), 698
Rumania :
Buzau, oil prospects of, 735
geophysical work in, 1115
petroleum consumption in, 616
petroleum exploitation in, 855, 1115
petroleum industry and railways of, 615
Russia. *See* U.S.S.R.
Ruston 7½ H.P. Horizontal Engine, 845

Sand :
compressibility of, 189
unconsolidated, fluid flow in, 1431
Sea, pollution of, by oil, 618
Scotland, oil-shale products, 1406
Shukov-Kapelyushnikov Cracking Unit, 693
Silicates, adsorptive properties of, 280
Sludge Acid, nitric esters from (P), 1065
Soaps, metallic, use of, 967

Sodium Plumbite, regeneration of, 563
Solids :
  extraction of, with liquids, 1060
  heating of, 910
Solvent Extraction :
  advantages of, 293
  asphaltic bitumen from, 303
  Bari-Sol plant, 1213
  Chlorex process, 167
  computations for, 440, 1349
  fundamentals of, 942
  furfural as solvent, 1058, 1214
  gas–propane mixture as solvent, 561
  Multi-Sol plant, 1214
  natural gas as solvent, 819, 1189
  nitrobenzene process, 295
  non-lubricating hydrocarbons (P), 433
  phenol process, 1210
  processes for, 166, 439, 442, 942–944, 1504
  (P), 79, 168, 296, 443, 588, 707, 827, 1084, 1217, 1394, 1505
  propane as solvent, 1216
  reflux in, 1215
Solvents :
  dry-cleaning, distillation of (P), 839
  kauri-butanol test for, 264
  manufacture of, 1403
  (P), 1515
  naphtha, properties of, 964
  recovery of, from sludge (P), 463
  toxicity of, 1059, 1402
  varnish, from coal–oil mixtures (P), 982
  from petroleum, 974, 1237
Spain :
  geophysical work in, 637
  oil production in, 469
Specific Gravity, correction chart for, 785
Specific Refraction, for determination of hydrocarbon composition, 55
Standard Sunbury Engine Indicator, 181
Steel :
  cutting of, gas for, 231
  quenching oils for, 177
Steiner Viscometer, 1053
Storage Installations :
  Brooklyn, N.Y., 533
  Revere, Mass., 226
Sulphonated Oils, analysis of, 970
Sulphonic Acids, reaction with amines, 131
Sulphur, recovery of, (P), 1245
Sulphur Compounds :
  in petroleum, 783
  manufacture of (P), 603, 975, 1245, 1405
  toxicity of, 1059
  uses of, 1511
Sulphur Dioxide :
  recovery of, from gases (P), 769
  thermal constants of, 1161
Sulphuric Acid, from waste gases, 64
Sumatra, Palembang refinery, 319
Surface Tension, determination of, 787
Suspensions, consistency of, 1233
Switzerland, oil prospects of, 104
Syria, petroleum exploration in, 1108
Tank Farms, fire fighting at, 1334
Tank Wagons :
  loading of, loss reduction, 1040
  measuring in, 765
Tankers :
  development of, 531
  maintenance of, 532
  " 13 de Diciembre," 123
Tanks :
  corrosion of, protection against, 1320
  earthen, losses in, 534
  explosions in, 385
  field, from old plates, 386
  measurement in, 221
  flow, heating of, 119
  gasoline, evaporation losses, 122
  moving of, 535
  oil weight determination (P), 69
  welding of, 657
Tar :
  coal, anthracene hydrogenation, 279
  distillation of (P), 1099
  free carbon in, 134
  gasoline from (P), 159
  distillation of (P), 721
  road, adhesive power of, 299
  viscosity of, 450, 832, 962
  tar acid recovery (P), 847, 1516
  use as fuel, 1220
Tar–Bitumen Mixtures, tar estimation, 558, 896
Tennessee :
  Nashville Dome, geology of, 1260
  Ridgetop shale, age of, 851
Testing of Oil :
  corrosion, copper strip cleaning, 1166
  use of quartz lamp, 144
Texas :
  Brenham salt dome, 102
  central, geology of, 6
  Clay Creek salt dome, 334
  Coastal, faulting in, 335
  Conroe, geology of, 478, 858
  drilling technique in, 1436
  East, geology of, 481
  oil production data, 336
  Frio County, geology of, 106
  geophysical work in, 997
  High Island dome, 738
  Hoskins Mound salt dome, 340
  New Hardin, geology of, 193
  Orange, geology of, 737
  Pearsall, geology of, 479
  Placedo, geology of, 194
  Plymouth, geology of, 477
  Port Isabel refinery, 1072
  Saxtet, geology of, 1111
  Somerset, geology of, 632
  south, geology of, 1270
  oil reserves of, 107, 1271
  producing zone selection in, 480
  Talco, crude oil analysis, 1358
  Tomball oilfield, geophysics of, 488
  West, dolometric limestone of, 100
  Wheat Pool, geology of, 859
  White Point, geology of, 1110
Tractor Fuel, cracked kerosine as, 427

Transformer Oil, classification of, 78
Transjordan, geology of, 1109
Transport :
  co-ordination of, 124
  gasoline, road *vs.* rail, 125
  wastes in, 1333
Trinidad :
  Palo Seco, geology of, 2
  petroleum industry of, 1102
Tunis, oil search in, 624

Uni-Coil Injection Cracking Process, 1089
United States :
  future oil requirements, 723
  liquified gas sales, 915
  petroleum geology in, 623
  petroleum policy of, 467
  petroleum resources of, 332, 333
  refineries in, 899, 900
  rock temperatures and depths, 472
Uruguay, geology of Devonian areas, 1261
U.S.S.R. :
  Apsheron peninsula, geological map of, 344
  Caucasus, micropalæontology of, 1423
  crude oils, fluorescence of, 232
  drilling research in, 356
  fuels and lubricants in, 1524
  Grozny, production methods, 371
  motor vehicles in, 1521
  petroleum exploration in, 13
  petroleum industry of, 186, 320–322, 612–614, 848, 1100, 1101, 1414, 1415
  petroleum policy of, 467
  pipe-lines of, 1039
  refinery developments in, 319
    statistics, 407
  Tertiary flora of, 343
  Ural-Emba, oil prospects of, 734
Utah, south-east, geology of, 4

Vapour Pressure, estimation of, 147
Vegetable Oils :
  viscosity determination, 395
  viscosity–temperature characteristics, 1469
Venezuela :
  geology of, 635
  petroleum policy of, 467
Viscometers :
  ball and bucket, 254
  concentric cylinder, 1340
  for vegetable oils, 395
  kinematic, 1339
  Marschalko, 83
  Ostwald, modified, 1052, 1339
  (P), 559
  rapid precision, 256
  Steiner, 1053
  suspended level, 253, 256, 1341
  U-tube, drainage errors, 252
Viscometry :
  logarithmic head correction, 136
  nomenclature of, 1051
Viscosity :
  determination of, of small samples, 255
  diluted oils, 137
  Engler, accuracy of, 140
  kinematic, 887
    relation to Redwood, 250, 251
  Redwood, relation to kinematic, 250, 251
  relation to constitution of oils, 773
  road tars, 450, 832, 962
  theory of, 888
  units of, interconversion of, 1475
Viscosity Index :
  asphaltic bitumen, 452
  determination of, 141
  tables for, 139

Water :
  salt, disposal of, 383, 505, 648, 873, 1032
  underground, geochemistry of, 1105
    iodine separation, 833, 965
Water Supply, from shallow sands, 27
Wax, recording, manufacture of, 309
Weed Killer, petroleum oils as, 602
Welders, training of, 684
Welding, electrodes for, 792, 793
Wells :
  abandoning of, 1444
  bottom-hole temperature measurement, 5
  cement for, fibrous materials in, 16, 1013
    temperature effect on strength, 365, 646
  cementing of, 1132
    boiler for (P), 1299
    failure causes, 366
    heat generation in setting, 1294
    location of cement (P), 639
  crooked, causing of, 1293
    straightening of, 1292
  fire extinction in, 1445
  paraffin removal, 216, 374
  photography in, 641, 1295
  reconditioning of, 205
  slanted, pumping of, 212
  thermometric measurements in, 493, 724
West Virginia, Oriskany and Corniferous sands, petrography of, 1262
Wetting Agents, manufacture of (P), 1145
Wood, impregnation of, petroleum products for, 1094
Wyoming, Laramie Basin, geology of, 1430

BOOK REVIEWS AND NOTICES SUBJECT INDEX.

Numbers refer to pages.

Alaska :
  southern range, geology of, 32A
  Tonsina, geology of, 116A
American Petroleum Industry, 173A
American Petroleum Institute, proceedings of, 230A
Argentina :
  geology of, 68A
  maps of, 68A
  oil statistics, 68A
  tin deposits of, 68A
Arizona, Jurassic formation of, 374A
Asphalt, history of, 372A
Aphalt Roads, 470A
Association Français des Techniciens du Petrole, Bulletin, 328A
A.S.T.M. Standards, 557A

Bentonite, properties and uses of, 327A
Bitumen, asphaltic, for roads, 68A
Bituminous Mixtures, sampling and testing of, 115A
Blending Charts, 69A
Brazil, oil-shale in, 372A
Bricks, testing of, 69A
British Empire, mining royalties and rents in, 175A

Canada :
  limestones of, 68A
  petroleum fuels in, 277A
Carbon Black, statistics of, in U.S.A., 175A
Carburation, 522A
Carolina, geology of, 472A
Chemistry :
  applied, reports on, 229A
  handbook of, 327A
Coal :
  chemistry and classification of, 174A
  hydrogen action on, 115A
  low-temperature carbonization of, 69A
  low-temperature carbonization, Coal Research Synd. process, 328A
  oil from, 116A
Colombia, oil industry of, 69A
Colorado :
  Jurassic formation of, 374A
  Montezuma Quadrangle, geology of, 70A
  San Juan, geology of, 116A
Corrosion Committee, report of, 522A
Cracking, theory and technique of, 67A

Distillation, 372A
Drilling :
  salt water disposal, 69A
  water contamination in, 69A

Emulsions, theory of, 115A
Encyclopaedia, technical and scientific, 67A
Engineering, commercial, 278A
Engines :
  compression-ignition, 66A
    combustion chamber design, 522A
    design of, 113A
    electric generators, 415A
    transport, 558A
    high-speed, 31A, 556A
    maintenance of, 326A, 415A
    standard practices in, 113A
  marine, welded frames, 372A

Flame, monograph on, 175A
Fluid Flow in Pipes, 327A
France :
  fuel oils in, 278A
  petroleum directory, 277A
Fuel, technical data on, 32A
Fuel Oil, burning of, 69A
Fuel Research Board, Report of, 31A
Fuels :
  industrial, 372A
  petroleum, uses of, 176A

Gases, commercial, 176A
Gasoline :
  analysis of, 277A
  natural, data on, 558A
Geophysical Surveying, patent literature on, 373A
Geophysics, journal on, 278A

Heat Transmission, 327A, 372A
Heating and Ventilation, design problems, 278A
Hydrocarbons, iso-butane, heat of combustion of, 70A
Hydrogenation, Bergius process, 115A

Idaho, Casto Quadrangle, geology of, 32A
Imperial College, Calendar of, 471A
Iron and Steel Institute, Proceedings, 472A

Lake Superior, Pre-Cambrian rocks of, 32A
Lubricants :
  developments in, 522A
  used, reclamation of, 277A

Mexico, geology of Tampico, 521A
Montana, phosphate rocks in, 472A

Natural Gas :
conservation of, 327A
production of, back-pressure data, 373A
flow data, 373A
statistics of, in U.S.A., 176A
New Jersey, Franklin and Sterling Hill, minerals of, 32A
New Mexico :
Jurassic formation of, 374A
Santa Rita Area, geology of, 32A

Ozokerite, 470A

Paraffin Wax, manufacture of, 175A
Pennsylvania, Bellefonte Quadrangle, geology of, 373A
Petroleum :
bulk handling of, 373A
origin of, 276A
Petroleum Charts and Tables, 69A
Petroleum Development and Technology, 416A
Petroleum Dictionary, 522A
Petroleum Technology, influence of on composite interest in oil, 176A
Petroleum Vademecum, 69A
Physics, handbook of, 327A
Production of Oil :
acid treatment of wells, 522A
subsurface pressure gauge, 32A
water disposal, 558A

Refinery Plant, design of, 326A
Road Aggregates, uses and testing, 65A
Rumania, petroleum industry of, 116A

Spain, petroleum monopoly in, 228A
Specifications, British Standard, 68A, 115A
Standardization, organization of, 558A
Steels :
creep test, use of, 373A
embrittlement of, 373A
Sulphonation, processes of, 276A

Tankers, 228A
development of, 327A
Tertiary Faunas, 65A
Tiles, testing of, 69A
Trinidad, annual report, 372A

United States :
carbon black statistics, 175A
natural gas statistics, 176A
Utah :
Book Cliffs coal field, 472A
Grand County, geology of, 472A
Jurassic formation of, 374A
Monument Valley-Navajo, geology of, 373A

Welding :
procedure handbook of, 174A
of Iron and Steel, 32A
Wire Ropes Research Committee, report of, 175A
World Power Conference, statistical year-book, 557A

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INSTITUTION NOTICES.

January 1936.

FORTHCOMING MEETINGS, 1936.

Friday, 24th January, at The Memorial Hall, Albert Square, Manchester, at 7.30 p.m.

Inauguration of a Northern Branch of the Institution and Address by Sir John Cadman, G.C.M.G., D.Sc., on **"The Applications of Science to the Petroleum Industry."**

Tuesday, 11th February, at The Royal Society of Arts, John Street, Adelphi, London.

Symposium of Papers on **"Welding in the Petroleum Industry."**

"Welding in Field and Drilling Equipment," J. Cuthill, A.M.Inst.P.T.

"Welding of Pressure Vessels," Eng. Lt. Commdr. S. F. Dorey, R.N., D.Sc., M.I.Mech.E.

"Welding in the Transportation and Storage of Petroleum Products," A. C. Hartley, M.Inst.C.E., M.I.Mech.E., M.Inst.P.T.

"The Training of Welders," R. T. Rolfe and W. G. Poole.

The meeting will commence at 5.30 p.m. and the four Papers will be briefly presented by their authors. From 6.30 to 7.0 p.m. there will be an interval for light refreshments, and the meeting will be resumed at 7.0 p.m. for exhibition of a film dealing with the welding of pipe-lines, and the general discussion of the Papers.

Tuesday, 10th March, at The Royal Society of Arts, London, at 5.30 p.m.

Annual General Meeting and Presidential Address by Sir John Cadman, G.C.M.G., D.Sc.

Tuesday, 7th April, at The Royal Society of Arts, London, at 5.30 p.m.

Symposium on **"Carbonization as a Source of Liquid Fuels."**

May 8th–12th. Meeting at The Hague.

STUDENTS' SECTION (LONDON BRANCH).

Tuesday, 4th February. At the Institution offices. **"The Economic Geography of Trinidad, Venezuela and Central America,"** Prof. L. Rodwell Jones, Ph.D.

Tuesday, 18th February, at the Institution offices.

Annual General Meeting.

"Oil Migration." P. M. Groves (Stud.Inst.P.T.).

ELECTION OF PRESIDENT.

Sir John Cadman, G.C.M.G., D.Sc., has been re-elected President of the Institution for the year 1936–37.

ELECTION OF VICE-PRESIDENTS.

At the Council Meeting held on December 10th, 1935, the following were elected Vice-Presidents of the Institution for the year 1936–37 : Lt.-Col. S. J. M. Auld, D.Sc., Ashley Carter, C. Dalley, Prof. A. W. Nash, M.Sc., J. McConnell Sanders, F.I.C., and Dr. F. B. Thole, D.Sc.

BALLOT LIST FOR COUNCIL.

The following Members of Council retire at the Annual General Meeting in March 1936, but are eligible for re-election : G. H. Coxon, Dr. F. H. Garner, Ph.D., M.Sc., J. S. Jackson, B.Sc., Dr. Arthur Wade, D.Sc.

Mr. C. A. P. Southwell, B.Sc., has been nominated as a candidate for the Council.

The Ballot List for Council, issued to all Members and Associate Members of the Institution in December 1935, accordingly contains the names of five candidates to fill four vacancies on the Council. Ballot Lists must be returned to the office of the Institution in time to be received before noon on Tuesday, March 10th, 1936.

NEW MEMBERS.

The following have been elected or transferred, subject to confirmation in accordance with Bye-Laws, Sect. IV, paras. 14–15, since the last issue of the *Journal*.

Member.

Fay, Eric	Maracaibo.

Transfer to Member.

Owen, Robert Meyer Sturt	London.

Associate Members.

Burgess, Stanley Grove	London.
Howgill, Donald Robert	Singapore.
Low, Ian Campbell	Devonshire.
Marks, Randolph Errol	Derby.
Tidy, Sydney George	Abadan.

Associates.

Rankin, George	Ecuador.
Soper, William Ewart	Istanbul.
Wykes, Frederick Edgar	Weymouth.

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NOMINATIONS FOR MEMBERSHIP.

The following nominations for membership of the Institution of Petroleum Technologists were approved by the Council on January 14th, 1936, and the Application Forms of the candidates may be seen at the office of the Institution.

The names of Proposer and Seconder are given in parentheses.

As Members.

BEALE, Evelyn Stewart Lansdowne, Consulting Physicist, 44, Markham Square, London, S.W. 3. (Sir John Cadman; A. E. Dunstan.)

BUCK, Edward Clarke, Consulting Engineer and Geologist, 31, St. Vincent Street, Port of Spain, Trinidad, B.W.I. (A. Beeby Thompson; Campbell M. Hunter.)

CASE, John Revill, Manager, British Burmah Petroleum Co., Yenangyaung, Upper Burma. (G. W. Lepper; C. E. Keep.)

DAVISON, William, Director, The Old House, Potters Heath, Welwyn, Herts. (J. Kewley; W. W. Gouleston.)

FAINGAR, Matvey Moiseevitch, Engineer, Apartments 10, Pawlowskaja Street 17, Moscow, U.S.S.R.

MACKLEY, Fred, Manager, 72, Westgate, Hale, Cheshire. (J. Kewley; W. W. Gouleston.)

As Associate Members.

FIRTH, William Ward, Chemist, Wenodene, Castle Drive, Whitby, Wirrall. (J. Kewley; W. W. Gouleston.)

FULLERTON, James Douglas, Engineer, c/o Apex (Trinidad) Oilfields, Fyzabad, Trinidad, B.W.I. (G. H. Scott; A. H. Richard.)

OVER, Jan, Chemical Engineer, c/o Asiatic Petroleum Co., Singapore. (A. D. Cooper; L. H. Cooper.)

As Student.

GRUNEBERG, Alan Conrad, Chemist, 18, Grove Avenue, Muswell Hill, London, N. 10. (D. A. Howes; D. G. Smith.)

As Associate.

HARRIS, Harold Arthur, Accountant, c/o Apex (Trinidad) Oilfields, Siparia P.O., Trinidad, B.W.I. (G. H. Scott; A. H. Richard.)

As Transfer to Associate.

LEITES, Eugene L., Assistant Manager, 14, Rue Beaujon, Paris. (V. C. Illing; L. Polak.)

INSTITUTE OF METALS.

The Council of the Institute of Metals invites discussion by correspondence on a paper by Dr. H. W. Brownsdon, M.Sc., on "Metallic Wear." Contributions should be limited to the problems of metallic wear in the presence of lubricants.

Copies of the paper can be obtained from the Secretary, Institute of Metals, 36, Victoria Street, Westminster, S.W. 1.

ARTHUR W. EASTLAKE,
Honorary Secretary.

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BRANCH NOTES.

Trinidad Branch.

The 8th Annual General Meeting of the Trinidad Branch was held on November 28th, 1935, when the Report of the Committee and Accounts for the year ended October 31st, 1935, were received and adopted. The Report and Accounts will be printed in the April issue of the *Journal*, following their submission to the members at the Annual General Meeting of the Institution on March 10th, 1936.

The following were elected members of the Trinidad Branch Committee for the Session 1935–36 :

Comm. H. V. Lavington, R.N. (Chairman).
L. A. Bushe.
J. L. Harris, M.C., M.Sc., A.R.S.M.
A. J. Ruthven-Murray, M.A., B.Sc.
E. C. Scott, M.C., B.Sc.
G. H. Scott, B.Sc.
H. W. Reid, B.Sc. (Hon. Secretary and Treasurer).

Mr. F. Middleton and Mr. D. M. Walsh were re-elected Hon. Auditors.

Following the Annual General Meeting of the Branch, Mr. E. C. Scott, M.C., B.Sc., presented a Paper on "Improved Drilling Speed and its Influence on Cost." About 45 members and guests were present.

Rumanian Branch.

The 9th Annual Dinner of the Rumanian Branch was held on Friday, December 7th, 1935.

Mr. P. R. Clark, Chairman of the Branch, presided over a company of about 80 members and their guests, including Dr. J. B. Hubrecht (Netherlands Minister and Plenipotentiary), Mr. Harrison (American Minister), Prof. Dr. Leon (Under-Secretary of State for Industry and Commerce), Mr. C. Alinanesteanu (Vice-President of the Senate) and Mr. Cezar Popescu (Director-General of Commerce in the Ministry of Industry and Commerce).

Burma Branch.

The Fourth Ordinary General Meeting of the Branch was held at the Volunteer Club, Yenangyaung on October 25th, 1935, Mr. W. E. V. Abraham, Deputy-Chairman presiding.

Mr. F. E. J. Foxall-Smedley, B.Sc., A.M.Inst.P.T., read a Paper on "Natural Gas Measurement," tracing the history of the development of the various types of gas meters, and discussing the uses and applications of each type.

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South Wales Branch.

On Friday, December 6th, 1935, Capt. W. H. Cadman, B.Sc., F.I.C., addressed a joint meeting of the South Wales Branch and the associated chemical and metallurgical societies of South Wales, held at the Metropole Hotel, Swansea. Capt. Cadman dealt with the production of motor fuels in Great Britain, and reviewed the present position of the search for petroleum in England, the production of oil from shale in Scotland and the production of petroleum products by the carbonization of coal. The address was illustrated by a film of the Scotch Shale Oil Industry.

The Chair was taken by Mr. W. C. Mitchell, Chairman of the Branch, and about 60 members and guests were present. The meeting was attended by the Secretary of the Institution.

Students' Section (London Branch).

Dr. L. Dudley Stamp, D.Sc., gave the first of the series of lectures on the economic geography of various oil-producing countries to the members of the Students' Section (London Branch) on Tuesday, December 17th, 1935.

Dr. Stamp dealt with Burma and the East Indies, and described the physical and climatic conditions of these countries and their effect on the distribution of vegetation, the area of settlement and development, and inland communications. The peoples and the economic development of Burma, Java and Borneo were compared and contrasted.

The lecture was illustrated by a large number of lantern slides and maps, and was followed by an excellent discussion. This lecture will be repeated before the Birmingham Branch of the Students' Section on Thursday, January 23rd.

PERSONAL NOTES.

Mr. C. M. G. Bolton is on his way home from the Gold Coast Colony.
Mr. R. Chandler has gone to India.
Mr. W. G. B. Coutts is now in Iran.
Dr. W. F. Hume has left for Egypt.
Mr. C. F. C. Moore is home from the Gold Coast.
Mr. I. G. Nixon has returned to Mexico.
Mr. R. M. S. Owen is home from Canada.
Mr. A. E. Page is home from Kenya.
Mr. G. H. Richards has left for Sarawak.

The Secretary would be glad to learn of the addresses of the following Members: G. S. Ffoulkes-Jones, D. R. Fyfe, A. MacLean, T. F. Mason, D. J. Pull, K. A. Spearing, and G. S. Urquhart.

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BINDING OF JOURNAL, VOL. 21.

Arrangements have been made with the printers of the *Journal*, Richard Clay & Sons, Ltd., The Chaucer Press, Bungay, Suffolk, for binding Vol. 21 of the *Journal*. Bindings are available in two styles:

Style A. Light green cloth, lettered gold.

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Cost of Binding Case	4*s.* 9*d.*
Cost of Binding and Postage	6*s.* 3*d.*
	11*s.* 0*d.*

Journals for binding should be forwarded to Richard Clay & Sons, Ltd., Bungay, Suffolk, and accompanied by a remittance.

EMPIRE EXHIBITION, SOUTH AFRICA, 1936.

During the period from September to December, 1936, a South African Exhibition, which will include displays from all parts of the Empire, will be held in Johannesburg.

The Chemical, Metallurgical and Mining Societies of South Africa and the South African Chemical Institute have extended an invitation to the members of the Institution of Petroleum Technologists likely to visit the Exhibition to avail themselves of the facilities of Kelvin House, Johannesburg.

Kelvin House is the headquarters of the Associated Scientific and Technical Societies of South Africa.

It is proposed that visitors be made Honorary Members of the Club House during their visit to Johannesburg, and they will be able to obtain any information they may require as to places of technical interest in the Union; they will also be able to obtain immediate introductions to local members of the respective professions, and visits will be arranged by the Associated Societies to places of mining, industrial or general scientific interest. Visitors will be specially welcomed to the various meetings of the ten Member Societies, and papers or contributions to the discussion of technical matters by them will be greatly appreciated.

CONTENTS OF FEBRUARY JOURNAL.

The following papers are scheduled for inclusion in the February issue of the *Journal*:

"Characteristics of Solvent-Refined Motor Oils." S. J. M. Auld.
"Solvent Extraction Processes." W. R. Wiggins and F. C. Hall.
"Computations for Counter-Current Solvent Extraction Processes." T. G. Hunter and A. W. Nash.

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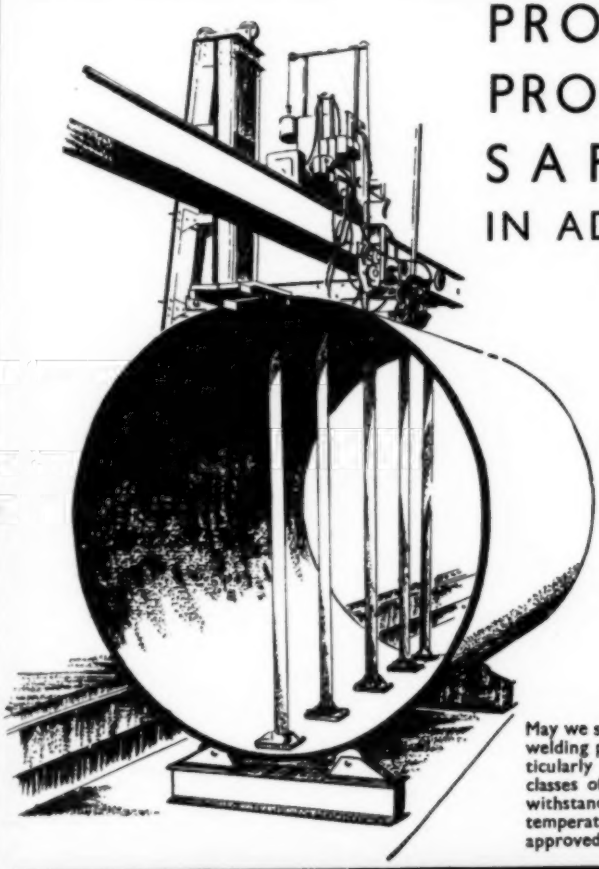

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NOTICES.

The Institution as a body is not responsible for the statements of opinion expressed in any of its publications.

Copyright.—Publication of abstracts of Papers and articles appearing in the Journal is permitted, provided that acknowledgment is made to the Institution of Petroleum Technologists.

Papers and Articles.—The Council invites Papers and Articles both for reading at Ordinary Meetings of the Institution and for publication in the *Journal*. All Papers, whether for reading or publication, will be submitted to a referee appointed by the Publication Committee.

The Institution has published a brochure "Instructions for the Guidance of Authors" containing details of recommended practice in the preparation of Papers for publication. Copies of this brochure will be supplied on request.

Pre-Prints.—Advance proofs of Papers to be read at Ordinary Meetings are generally available about a week before the Meeting. Members wishing to be supplied with these pre-prints are requested to notify the Secretary.

Abstracts.—Members and Journal Subscribers desirous of receiving the Abstracts printed on one side of the paper only, can be supplied with these at a charge of 10*s*. per annum per copy, payable in advance.

Issue of Journal.—Members whose subscription is not in arrear receive the *Journal* free of cost. A member whose subscription is not paid by March 31st of the year for which it is due is considered to be in arrear.

Changes of Address.—Members are requested to notify any change of address to the Secretary.

Benevolent Fund.—The Benevolent Fund is intended to aid necessitous persons who are or have been members of the Institution, and their dependent relatives.

The Fund is raised by voluntary annual subscriptions, donations, and bequests, and all contributions should be sent to the Secretary of the Institution at Aldine House, Bedford Street, London, W.C. 2. The Fund is administered by the Council through the Benevolent Fund Committee, and all applications in connection therewith must be made on a special form which can be obtained from the Secretary of the Institution.

Appointments Register.—A register of members requiring appointments is kept at the offices of the Institution, and every effort is made to assist members of the Institution in search of employment.

Members who desire their names and qualifications to be included in this register are requested to apply to the Secretary for the Form of Application for Registration, if they have not already done so. Members residing in the London area are asked, if possible, to return this Form in person and make themselves known, together with their requirements, to the Secretary. It is also requested that members should notify the Secretary immediately they have obtained an appointment.

In submitting names of candidates to prospective employers it is understood that the Institution accepts no responsibility and gives no guarantee.

Library.—The Institution's Library may be consulted between the hours of 9.30 a.m. and 5 p.m. daily. (Saturdays, 9.30 a.m. to 12 noon.)

INSTITUTION NOTES.

FEBRUARY 1936.

MEETINGS IN HOLLAND AND GERMANY.

THE Institution is holding its first European meeting in May. The membership of the Institution and the petroleum industry itself are of such an international character that it has perhaps hardly seemed necessary in the past to organize meetings abroad. Yet the advantages of belonging to a technical society are not complete unless they provide opportunities for wider contacts than are possible to the individual. It often happens that the value of an overseas meeting lies not so much in the papers discussed at the technical sessions, as in the friendly contacts established on the less formal occasions of works visits and social functions.

The Institution is fortunate in that its first venture overseas is to be made in two countries which are second to none in their contributions to the technology of petroleum. In both Holland and Germany visitors are assured that they will not only meet experts in their own particular branch of the industry, but also that they will receive the generous hospitality characteristic of both countries.

The May meeting is, in effect, two meetings. The chemist and refinery technician will probably find greatest interest in the meetings at The Hague and Amsterdam. To the geologist and production engineer the opportunity of visiting the oil-fields of Nienhagen, Wietze and Oberg will appeal more strongly. The travel arrangements, which have been completed, permit members to participate in either or both of these two sections of the meeting. The circular to be issued to all members of the Institution refers only to travel arrangements from London, but it is hoped that members resident in Europe or coming home on leave

will be able to join their fellow-members either at The Hague or Hanover.

The Institution is indebted to the Royal Dutch Institute of Engineers, The Hague, which is acting as official host for the meetings in Holland. The President of the Royal Dutch Institute, Prof. L. A. van Royen, is acting as Chairman of the Reception Committee, and Prof. Dr. H. I. Waterman as Vice-Chairman. The Council of the Institute has placed at the disposal of visitors their premises in The Hague to serve as a central office during the meetings. The Secretary of the Institute, Mr. W. Cool, is undertaking much of the detailed work of organisation.

The arrangements for the visit to Hanover have been made by Dr. Alfred Bentz, Consulting Geologist. The Institution is indebted both to him and to the Fachgruppe Erdolbergau for the hospitality offered to members, as well as for the extremely interesting programme of visits which is proposed.

It is perhaps necessary to issue a word of warning that Holland is not a cheap country for visitors from England. The current rate of exchange is 7·25 florins per pound, and the cost of living in Holland makes the pound sterling approximately the equivalent of 12*s*. 6*d*. The utmost that can be done to keep the cost within reasonable limits has been done, and it was for this reason that the Council placed the travel arrangements with Messrs. Thos. Cook & Sons, whose wide organization is able to obtain favourable rates for travelling and hotel accommodation.

In addition, the Institution is indebted to the Bataafsche Petroleum Maatschappij, the Anglo-Iranian Oil Company and The American Petroleum Company, N.V., for generous donations towards the expenses of the various social functions.

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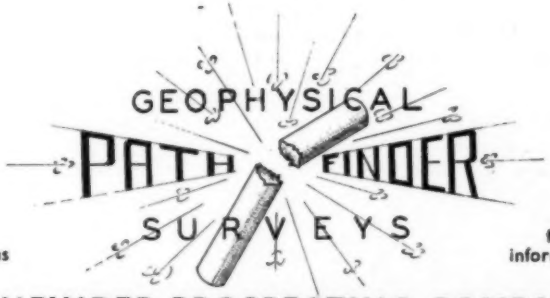

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AWARD OF SCHOLARSHIP.

The Institution Scholarship, tenable at the University of Birmingham, has been awarded to C. S. Newey, Stud.Inst.P.T.

METHOD OF ELECTION OF MEMBERS.

At their meeting on January 14th, the Council adopted a report of the Election Committee, which recommended the substitution of Election by Council for Election by a Postal Ballot.

The various circumstances which led to this recommendation have been given in a circular issued to all members of the Institution with the Annual Report.

The alterations in By-Laws necessary to give effect to the recommendation will be submitted at the Annual General Meeting on March 10th, 1936.

NEW MEMBERS.

The following have been elected or transferred, subject to confirmation in accordance with By-Laws, Sect. IV, paras. 14–15, since the last issue of the *Journal*.

Members.

Bennion, John Edward	Manchester.
Braileanu, Ion G.	Prahova.
Cox, Percy Thomas	London.
Godfrey, William Edgar	Sunbury-on-Thames.
Leslie, Robert Wilson	Kansas.

Associate Members.

Dean, Cecil Percy	Peru.
Sefton, Ronald	London.

Transfer to Associate Members.

Hobley, Charles Edward	Maracaibo.
Lindsay, John Alexander	London.
Sangster, Eric Bruce	Birmingham.

Students.

Brown, Guido Waldo Herbert	Trinidad.
De Nie, Willem Leendert Johannes	Delft.
Holbrook, Edward Morison	Birmingham.
Jennings, William Munro, Jr.	Richmond.
Moore, Philip Harold	Birmingham.
Nissan, Alfred Heskel	Birmingham.
Thi, Maung Ba	Birmingham.
Verdonk, Gijsbert	Delft.
Verteuill, Louis Rene de	Trinidad.

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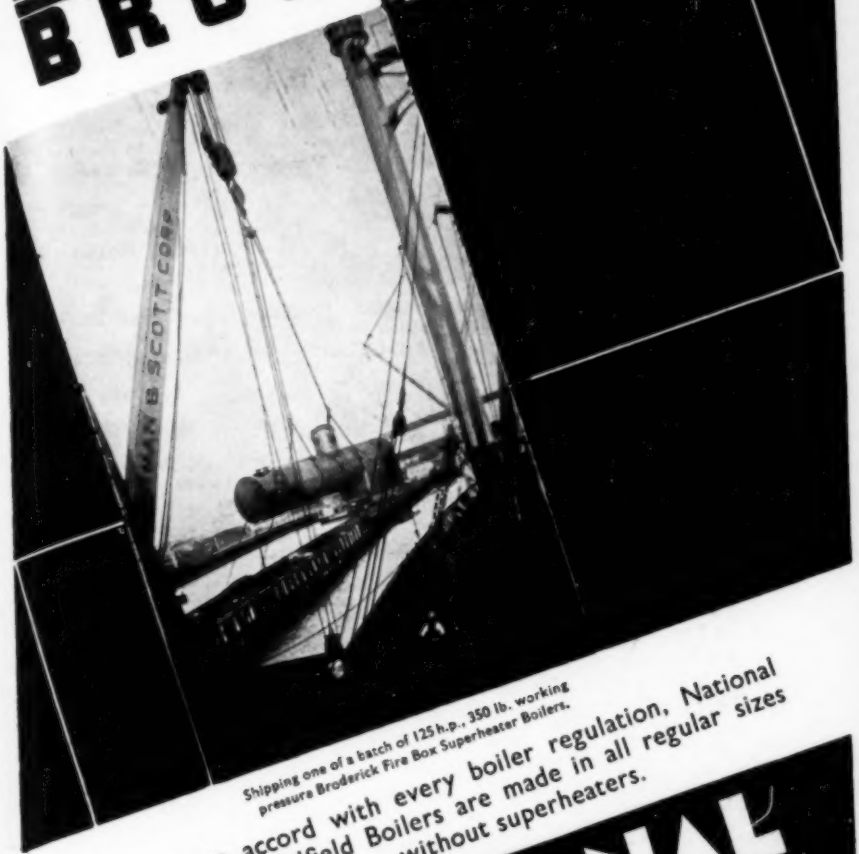

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NOMINATIONS FOR MEMBERSHIP.

The following nominations for Membership of the Institution of Petroleum Technologists were approved by the Council on February 11th, 1936, and the Application Forms of the candidates may be seen at the office of the Institution.

The names of Proposer and Seconder are given in parentheses.

As Members :

EYLES, Harold Beeching, Branch Manager, 15, Ollerbarrow Road, Hale, Cheshire. (A. E. Dunstan : J. Kewley.)

FOTHERGILL, Hugh Cyril Stanislaus, Sales Manager, c/o Anglo-American Oil Co., Ltd., 58, Whitworth Street, Manchester. (D. S. Paul : H. C. Tett.)

MAXWELL, Douglas Irving, Director, Myra, Texas, U.S.A. (C. R. Young : C. R. Brasier.)

PERQUIN, Johannes Nicolaas Jacobus, Chemical Engineer, Pantjoer 9, Balikpapan, Borneo, Dutch East Indies. (H. I. Waterman : M. de Blank.)

ZUBLIN, John Adolphus, Engineer, 2369, East 51st Street, Los Angeles, California, U.S.A. (A. Beeby Thompson : T. T. McCreath.)

As Students :

BLACK, John Linton, Assistant Chemist, Lensbury Club, Broom Road, Teddington. (J. S. Jackson : J. Parrish.)

CAHILL, Patrick, Laboratory Assistant, 18, Dudley Road, Wimbledon, S.W.19. (A. R. Stark : Patrick Docksey.)

As Associates :

DAVID, Reginald, Lubricating Manager, 9, Gayton Crescent, Hampstead, N.W.3. (G. W. D'Arcy-Evans : Walter Kay.)

HALL, Albert Edward Nichol, Engine Tester, Apple Garth, Fraley Road, Westbury-on-Trym, Bristol. (E. M. Shipman : R. H. L. Lee.)

ARTHUR W. EASTLAKE,
Honorary Secretary.

MEETING IN TULSA, U.S.A.

A meeting of members of the Institution in the United States will be held in Tulsa on May 15th, 1936, the day before the opening of the 9th International Petroleum Exposition, May 16th–23rd.

A Dinner will be held at the Hotel Mayo on the evening of May 15th. Addresses will be given by Dr. Gustav Egloff of Chicago, and Dr. Robert E. Wilson of New York. It is hoped that Mr. Wallace E. Pratt will also be able to address the meeting.

The following Committee has been formed to make the arrangements :—

Dr. C. K. FRANCIS, Tulsa, *Chairman*; Dr. BENJAMIN T. BROOKS, New York; Mr. T. G. DELBRIDGE, Philadelphia, Pa.; Dr. GUSTAV EGLOFF, Chicago, Ill.; Mr. K. G. MACKENZIE, New York; WALTER MILLER, Ponca City, Okla.; G. H. VAN SENDEN, San Francisco, Calif.; Mr. JOHN R. SUMAN, Houston, Texas; Dr. ROBERT E. WILSON, New York.

Members of the Institution resident in the United States, or intending to visit Tulsa for the Petroleum Exposition, should communicate as early as possible with Dr. C. K. Francis, 1221, East 29th Place, Tulsa, Oklahoma, for further particulars regarding this meeting.

2ND WORLD PETROLEUM CONGRESS.

The Organizing Committee of the 2nd World Petroleum Congress has issued a preliminary circular. The Congress will be held in Paris in June 1937 on the occasion of the International Exhibition.

The General Programme of the Congress will comprise five sections :—

Geology and Drilling.
Physical Chemistry and Refining.
Materials and Construction.
The Utilisation of Liquid Fuels.
Economics and Statistics.

This division of the programme corresponds to the five sections of the Association Française des Techniciens du Pétrole, which is carrying out the work of organisation.

The programme will include plenary and sectional sessions, works visits and social functions. At the conclusion of the Congress study-tours will be arranged.

The membership fee has been fixed at 50 francs for Members of the Congress; persons accompanying Members of the Congress, but not taking part in its meetings, can do so on payment of 25 francs. Applications for enrolment should be forwarded before April 1st, 1937, to :—*Le Secretariat Général du Congres, 85, Boulevard du Montparnasse, Paris (VI^e).*

The official language of the Congress will be French, but communications and lectures may be presented in English.

Communications on any subject covered by the programme of the Congress are invited, and should be submitted before February 1st, 1937. The length of papers should be from 4000 to 5000 words, and they must be accompanied by a summary not exceeding 400 words.

BRANCH NOTES.

Iranian Branch.

The first meeting of the 1935–36 Winter Session was held in the second week of November at Abadan. Mr. E. C. Brewster was in the Chair, and a lecture was given by Mr. G. H. Coxon (Member of Council) entitled "Commercial Progress." Approximately 100 people were present.

Mr. Brewster, in opening the meeting, mentioned that it was now their policy to extend a welcome to all who might be interested, whether members of the Institution or not, and he was pleased to note the large attendance. He added that this was actually the first meeting which ladies had attended.

The lecturer then proceeded to draw parallels concerning the commercial progress which had been made in the industry as a whole during the past year. This was followed by a keen discussion, covering many subjects. The general opinion was that the opening meeting had been very successful.

Mr. Coxon expressed the gratification of the Council at the keen interest which is now being shown by the Members of this Branch in its work.

Students' Section (London Branch).

The second of the series of lectures on the "Political and Economic Geography of various Oil Producing Countries" was given on Tuesday, February 4th.

Prof. L. Rodwell Jones, Ph.D., Professor of Geography at the University of London, dealt with the geographical features of Peru, Colombia and Venezuela.

The lecture was fully illustrated with lantern slides showing the surface features and types of vegetation met with in these countries.

PERSONAL NOTES.

Mr. W. C. Mitchell, B.Sc., M.Inst.C.E., has been awarded the Fellowship of the City and Guilds Institute.

Mr. J. A. Butlin has left for Burma.

Mr. C. H. Carter has returned home from Burma.

Mr. G. C. F. Greant is in Iraq.

Mr. J. G. Smillie has left Venezuela and is now in Ecuador.

The Secretary would be glad to learn of the addresses of the following Members:—G. S. Froulkes-Jones, R. G. Froulkes-Jones, D. R. Fyfe, R. E. Goldsbrough, T. F. Mason, A. N. K. S Mohandes, D. J. Pull, K. A. Spearing, and G. S. Urquhart.

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INTERNATIONAL PETROLEUM EXPOSITION.

Tulsa, Oklahoma, May 16th–23rd, 1936.

The 9th International Petroleum Exposition is being held at Tulsa, Oklahoma, U.S.A., on May 16th–23rd, 1936. Meetings of the following technical societies are being held in Tulsa at the same time as the Exposition: the American Petroleum Institute, the American Association of Mechanical Engineers and the American Institute of Mining and Metallurgical Engineers.

Visitors to the Exposition are invited to attend any or all of the Sessions of these societies..

In addition, as announced on p. vi, a special meeting is being held on the evening of May 15th for members of the Institution of Petroleum Technologists visiting Tulsa at this time.

Visitors and official delegates from nations outside the United States will have a special programme. They will be guests at a luncheon of the Rotary International club of Tulsa. Special tours for these visitors are being planned by the Exposition to several oil-fields. The Fitts pool and the Glenpool districts will furnish two opposite examples of American fields; the Fitts as an example of difficult deep drilling and a new field; the Glenpool as an example of shallow drilling and settled production.

Tours will also include the Oklahoma City Field, where visitors may see big equipment in operation, including all kinds of pumping units. Those interested in geological formations may take the tour to the Arbuckle mountains in Oklahoma, where all the formations in both the Seminole and Oklahoma City fields come to the surface.

BINDING OF JOURNAL, VOL. 21.

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NOTICES.

The Institution as a body is not responsible for the statements of opinion expressed in any of its publications.

Copyright.—Publication of abstracts of Papers and articles appearing in the Journal is permitted, provided that acknowledgment is made to the Institution of Petroleum Technologists.

Papers and Articles.—The Council invites Papers and Articles both for reading at Ordinary Meetings of the Institution and for publication in the *Journal*. All Papers, whether for reading or publication, will be submitted to a referee appointed by the Publication Committee.

The Institution has published a brochure "Instructions for the Guidance of Authors" containing details of recommended practice in the preparation of Papers for publication. Copies of this brochure will be supplied on request.

Pre-Prints.—Advance proofs of Papers to be read at Ordinary Meetings are generally available about a week before the Meeting. Members wishing to be supplied with these pre-prints are requested to notify the Secretary.

Abstracts.—Members and Journal Subscribers desirous of receiving the Abstracts printed on one side of the paper only, can be supplied with these at a charge of 10s. per annum per copy, payable in advance.

Issue of Journal.—Members whose subscription is not in arrear receive the *Journal* free of cost. A member whose subscription is not paid by March 31st of the year for which it is due is considered to be in arrear.

Changes of Address.—Members are requested to notify any change of address to the Secretary.

Benevolent Fund.—The Benevolent Fund is intended to aid necessitous persons who are or have been members of the Institution, and their dependent relatives.

The Fund is raised by voluntary annual subscriptions, donations, and bequests, and all contributions should be sent to the Secretary of the Institution at Aldine House, Bedford Street, London, W.C. 2. The Fund is administered by the Council through the Benevolent Fund Committee, and all applications in connection therewith must be made on a special form which can be obtained from the Secretary of the Institution.

Appointments Register.—A register of members requiring appointments is kept at the offices of the Institution, and every effort is made to assist members of the Institution in search of employment.

Members who desire their names and qualifications to be included in this register are requested to apply to the Secretary for the Form of Application for Registration, if they have not already done so. Members residing in the London area are asked, if possible, to return this Form in person and make themselves known, together with their requirements, to the Secretary. It is also requested that members should notify the Secretary immediately they have obtained an appointment.

In submitting names of candidates to prospective employers it is understood that the Institution accepts no responsibility and gives no guarantee.

Library.—The Institution's Library may be consulted between the hours of 9.30 a.m. and 5 p.m. daily. (Saturdays, 9.30 a.m. to 12 noon.)

INSTITUTION NOTES.

March 1936.

FORTHCOMING MEETINGS.

Monday, 6th April, 1936, at 5.30 p.m. at the Royal Society of Arts, John Street, Adelphi, W.C.2. Papers on **"Carbonization as a Source of Liquid Fuels."**

Particulars of the authors of the Papers and availability of advance copies will be announced later. PLEASE NOTE CHANGE OF DATE.

May 7th–15th, 1936. Meetings in Holland and Germany. Details of these Meetings and travel arrangements are published separately to all members of the Institution.

May 15th, 1936. Meeting of members of the Institution in U.S.A. at the Hotel Mayo, Tulsa, Oklahoma. Members wishing to participate in this meeting should communicate with Dr. C. K. Francis, Ph.D., 1221, East 29th Place, Tulsa, Oklahoma, U.S.A.

REPORT OF BALLOT FOR COUNCIL.

Five names were received to fill four vacancies on the Council. The result of the Ballot which was opened on March 10th and announced at the Annual General Meeting, was that the following were elected Members of the Council :—

G. H. Coxon.
F. H. Garner, Ph.D., M.Sc., F.I.C.
J. S. Jackson, B.Sc., F.I.C.
A. Wade, D.Sc., A.R.C.S., F.G.S.

STUDENTS' PRIZES.

Papers submitted for the Students' Medal and Prize and for the Students' Prize presented by Mr. T. C. J. Burgess must be received at the Institution not later than **30th September, 1936.**

Full particulars of the conditions of award may be obtained from the Secretary of the Institution.

EASTER 1936

The Offices and Library of the Institution will be closed from 5.0 p.m. on Thursday 9th April to 9.30 a.m. on Tuesday 14th April, 1936.

NEW MEMBERS.

The following have been elected or transferred, subject to confirmation in accordance with By-Laws, Sect. IV, para. 14–15, since the last issue of the *Journal*.

Members.

Beale, Evelyn Stewart	London.
Buck, Edward Clarke	Trinidad.
Case, John Revill	Yenangyaung.
Davison, William	Welwyn.
Faingar, Matvey Moiscevitch	Moscow.
Mackley, Fred	Hale.

Associate Members.

Firth, William Ward	Whitby.
Fullerton, James Douglas	Trinidad.
Over, Jan	Singapore.

Student.

Gruneberg, Alan Conrad	London.

Associate.

Harris, Harold Arthur	Trinidad.

Transfer to Associate.

Leites, Eugene L.	Paris.

NOMINATIONS FOR MEMBERSHIP.

The following nominations for Membership of the Institution of Petroleum Technologists were approved by the Council on February 11th, 1936, and the Application Forms of the candidates may be seen at the office of the Institution.

The names of Proposer and Seconder are given in parentheses.

As Members :

Eyles, Harold Beeching, Branch Manager, 15, Ollerbarrow Road, Hale, Cheshire. (A. E. Dunstan : J. Kewley.)

Fothergill, Hugh Cyril Stanislaus, Sales Manager, c/o Anglo-American Oil Co., Ltd., 58, Whitworth Street, Manchester. (D. S. Paul : H. C. Tett.)

Maxwell, Douglas Irving, Director, Myra, Texas, U.S.A. (C. R. Young : C. R. Brasier.)

Perquin, Johannes Nicolaas Jacobus, Chemical Engineer, Pantjoer 9, Balikpapan, Borneo, Dutch East Indies. (H. I. Waterman : M. de Blank.)

Zublin, John Adolphus, Engineer, 2369, East 51st Street, Los Angeles, California, U.S.A. (A. Beeby Thompson : T. T. McCreath.)

As Students :

Black, John Linton, Assistant Chemist, Lensbury Club, Broom Road, Teddington. (J. S. Jackson : J. Parrish.)

Cahill, Patrick, Laboratory Assistant, 18, Dudley Road, Wimbledon, S.W.19. (A. R. Stark : Patrick Docksey.)

As Associates :

David, Reginald, Lubricating Manager, 9, Gayton Crescent, Hampstead, N.W.3. (G. W. D'Arcy-Evans : Walter Kay.)

Hall, Albert Edward Nichol, Engine Tester, Apple Garth, Fraley Road, Westbury-on-Trym, Bristol. (E. M. Shipman : R. H. L. Lee.)

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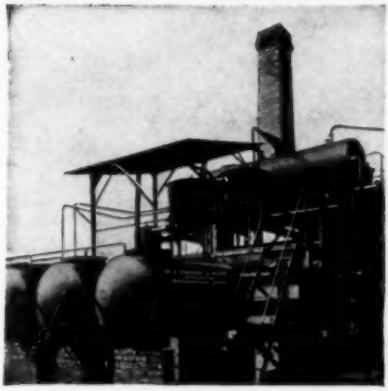

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CANDIDATES FOR ADMISSION.

The following have applied for admission to the Institution, or transfer to another grade of membership, and in accordance with the By-Laws the proposals will not be considered until after the lapse of at least one month subsequent to the issue of this *Journal*, during which any Member or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of any candidate.

The object of this information is to assist the Council in grading candidates according to the class of membership.

The names of the candidate's proposer and seconder are given in each case.

ANFILOGOFF, Nicholas Lionel (Trans. : from A.M.), Chief Technical Adviser, Texas Oil Co., Ltd., Thames House, Millbank, S.W.1. (Alfred C. Adams; T. C. J. Burgess.)

COWLISHAW, Geoffrey E., Oils and Fats Chemist (*Benjamin R. Vickers & Sons, Ltd.*), "Gables," 44, Sefton Terrace, Leeds, 11. (J. S. Parker; V. Biske.)

DEKKER, Jan Arie, Petroleum Engineer (*Independent Operator*), Strada I.C. Bratianu No. 11, Ploesti, Rumania. (J. L. Chaillet; C. R. Young.)

DEWAR, Keneth George Outram Deas, Chemist (*Anglo-Iranian Oil Company*), 6, Cornwall Road, Bedford. (A. E. Dunstan; D. C. Smith.)

FISCHER, Dr. Ing. Raoul Konrad, Technical Manager (*Messrs. Foster Wheeler Ltd.*), 2, Bedford Place, London, W.C.1. (E. Lawson Lomas; E. A. Satchell.)

FUCHS, George Hugo von, Chemical Engineer, Shell Petroleum Corpn., Wood River, Illinois, U.S.A. (F. L. Garton; T. B. Rendel.)

GLENDINNING, Donald Macleod, Refinery Engineer (*Lobitos Oilfields, Ltd.*), Millyea, Farr Hall Drive, Heswall, Cheshire. (J. S. Parker; V. Biske.)

GRAY, Kenneth Washington (Trans. : from A.M.), Geologist, c/o Anglo-Iranian Oil Co., Britannic House, Finsbury Circus, London, E.C.2. (G. M. Lees; C. A. P. Southwell.)

HANCOCK, James Gordon, Refinery Assistant (*Shell Refineries, Ltd., Stanlow*), 5, Estrand Terrace, Stanney Lane, Whitby, Wirral, Cheshire. (J. Kewley; W. W. Goulston.)

HOPKINSON, James, Engineer, c/o Iraq Petroleum Co., Kirkuk, Iraq. (G. Heseldin; W. E. D. Cole.)

INGRAM, Maurice, Transport Manager (*Lobitos Oilfields, Ltd.*), 8, Old Hall Drive, Whitby, Wirral, Cheshire. (J. S. Parker; V. Biske.)

JAFAR, Dhya Ul-Deen, Student, Mechanical Engineering Department, University, Edgbaston, Birmingham. (A. W. Nash; L. V. W. Clark.)

MACKILLIGAN, Robert Springett, Geologist and Petroleum and Mining Engineer, c/o Lloyds Bank, Ltd., 6, Pall Mall, S.W.1. (Sir John Cadman; C. A. P. Southwell.)

MACNIVEN, Hugh, Engineer, c/o Khanaqin Oil Co., Ltd., Naft Khanet, Iraq. (C. S. Cleverley; J. M. Pattinson.)

PRIKEL, Gottfried, Field Manager and Engineer, "Astra Romana," Moreni, Prahova, Rumania. (J. L. Chaillet; P. R. Clark.)

ROEGIERS, Michel, Managing Director (*Elektrion Oil Works, Ghent*), 197, Coupure, Ghent, Belgium. (E. A. Evans; A. E. Dunstan.)

SKILLING, Norman Lillie, Lubricating Oil Salesman, Anglo-American Oil Co., The Basin, The Docks, Preston. (C. E. Burnett; J. G. Jenkin.)

STRINGER, Norman Reginald, Oil Chemist (*Record Oil and Grease Co., Ltd.*), Grasmere, Bramhall, Cheshire. (R. J. Stringer; E. R. Redgrove.)

TAYLOR, Theo Mallinson, Assistant Chemist (*Shell Central Laboratories*), 44, West Cromwell Road, Earls Court, London, S.W.5. (J. S. Jackson; J. Parrish.)

WOOD-MALLOCK, James Campbell, Distillation Superintendent (*Lobitos Oilfields, Ltd.*), 9, Old Hall Drive, Whitby, Wirral, Cheshire. (J. S. Parker; V. Biske.)

ARTHUR W. EASTLAKE,
Honorary Secretary.

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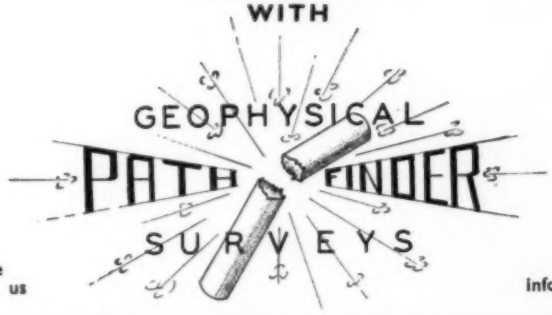

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BRANCH NOTES.

Inauguration of the Northern Branch.

The Northern Branch of the Institution was inaugurated by the President at a very successful meeting held in the Memorial Hall, Manchester, on Friday, 28th February, 1936. The attendance was estimated at over 400.

Mr. H. C. S. Fothergill, Chairman of the Northern Branch, occupied the Chair, and referred at the beginning of the meeting, in very pleasing terms, to the support given to the Branch by the President and Council. In addition to the President, the following members of Council were present: Dr. A. E. Dunstan, Mr. J. Kewley, Mr. G. H. Coxon, Mr. A. F. Dabell, Mr. E. A. Evans, Mr. W. Gooday, Dr. E. R. Redgrove and Mr. C. W. Wood. The meeting was also attended by Mr. S. J. Astbury, Mr. G. Sell, Mr. C. A. P. Southwell and Capt. W. H. Cadman.

The President's Address on "The Applications of Science to the Petroleum Industry" stressed the extent of the field covered by the petroleum industry and the value of the contributions made by every Science—Geology, Geophysics, Chemistry, Metallurgy, Biology, etc.—to the successful development of the industry in all its aspects.

A vote of thanks to the President was proposed by Mr. J. E. Haslam, M.Inst.P.T., and seconded by Dr. A. McCulloch (Manchester College of Technology).

Dr. A. E. Dunstan referred briefly to the activities of other Branches of the Institution, and observed that the Northern Branch was the first Branch which would be occupied mainly with problems of the utilization of petroleum products.

Mr. J. E. Bennion (Hon. Secretary of the Northern Branch) reported that the Branch had already about 60 Branch members, in addition to the members of the Parent Institution resident in that area.

Prior to the meeting in the Memorial Hall, a Reception and Dinner had been held at the Clarendon Club. The Rt. Hon. the Lord Mayor of Manchester (Alderman T. S. Williams) extended a welcome to Sir John Cadman on behalf of the Civic Authorities, and assured him that the City of Manchester was very pleased to have a local Branch of the Institution of Petroleum Technologists. Mr. H. M. Gibson (late General Manager of the Ship Canal) and Prof. A. H. Gibson (Manchester University), as representing Commercial and Educational interests, also welcomed the President and the Institution to Manchester.

Burma Branch.

The Annual General Meeting of the Burma Branch was held on the 14th February, 1936, at the Volunteer Club, Yenangyaung.

The Annual Report and the Accounts for the year 1935 were

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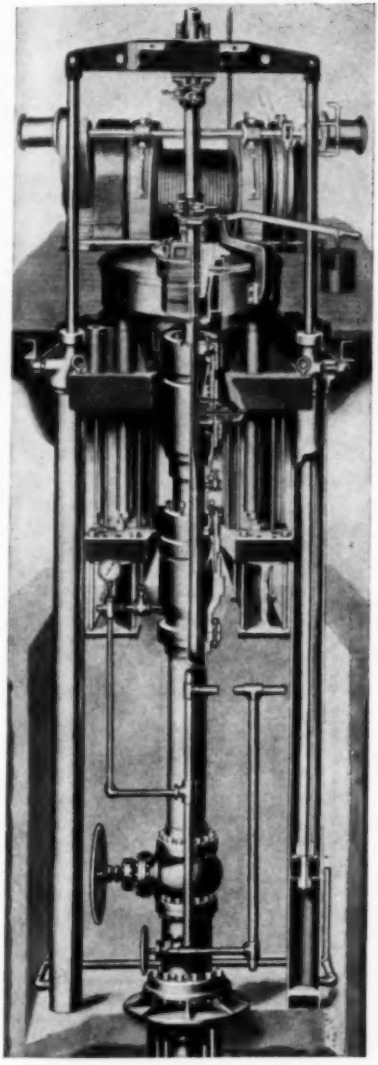

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approved unanimously, and the election of office-holders and three Additional Members of the Committee was then conducted.

The new Committee for the year 1936 was elected by ballot of the Branch Members present, and consists of :—

Chairman :	W. E. V. Abraham, A.R.C.S., B.Sc.
Deputy Chairman :	J. A. Butlin.
Hon. Secretary and Treasurer :	C. E. Keep, M.Sc., F.G.S.
Additional Members of Committee :	T. J. F. Armstrong.
	J. L. Benard.
	E. J. Bradshaw.
	G. Cotton.
	G. A. F. Grindle.
	R. C. Parker.
	J. Rankine.

Iranian Branch.

Two interesting Meetings of the Iranian Branch were held in November and December 1935.

Mr. J. M. Moore, B.Sc., gave a talk on "The Scientific Control of Labour" to a well-attended meeting of the Branch on 18th November, 1935. Mr. Moore explained the system known as the Bedaux system for the scientific measurement of labour output.

On 16th December, 1935, Mr. P. T. Cox, B.Sc., gave a lecture on "The Rôle of Salt, Gypsum and Anhydrite in the Iranian Oil-fields."

Mr. Cox described briefly the peculiarities of the strata in South Iran and Arabia. He dealt with the functions of these three minerals, and how they indicated to the geologist the probability or otherwise of oil-bearing zones.

Both the above meetings were followed by an excellent discussion.

Rumanian Branch.

The 52nd General Meeting of the Rumanian Branch was held at the Chamber of Commerce, Ploesti, on Friday, 15th November, 1935. Mr. Percy R. Clark, Chairman of the Branch, presided over an attendance of about 40 members and visitors.

In introducing Mr. O. Bell to the meeting, the Chairman referred to the fact that Mr. Bell had already won a name for himself in Rumania as a brilliant refinery chemist. The subject on which Mr. Bell would speak—Lubrication—was daily engaging more and more attention from industrial managers and engineers.

Mr. Oswald Bell then presented his Paper on "Trends in the Manufacture and Use of Lubricating Oils." The Paper was followed by a good discussion.

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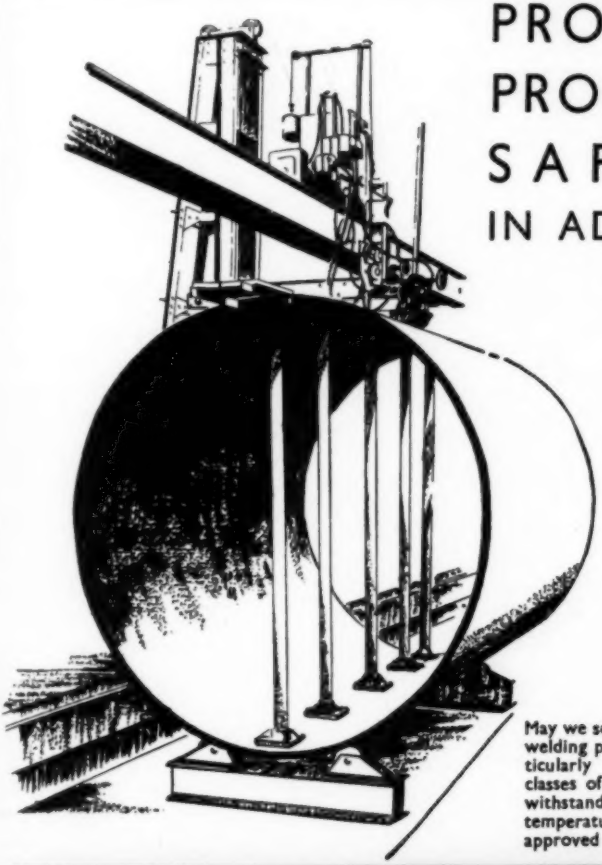

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PERSONAL NOTES.

Mr. D. A. C. Dewdney is home from Iran.
Mr. G. S. Dilley has returned from Sarawak.
Mr. F. E. Hunter has returned from Rumania.
Mr. D. Glynn Jones is home from Argentina.
Mr. F. A. Marr has returned from Assam.
Mr. Niels Matheson is home from Venezuela.
Mr. T. W. Muncaster has returned from Iran.
Mr. C. C. Mylles is home from Iran.
Mr. F. A. Shuter has left Palestine, and is now in Iraq.
Mr. G. S. Tate is home from Venezuela.
Mr. C. Thomas has returned from Assam.
Mr. G. S. Urquhart has returned to Burma.
Mr. L. F. Whittingdale is in Austria.
Mr. S. G. Wraight is home from Mexico.

The Secretary would be glad to learn of the addresses of the following Members :—C. W. Fulcher, D. R. Fyfe, R. E. Goldsbrough, T. F. Mason, A. N. K. S. Mohandes, P. E. T. O'Connor, D. J. Pull, K. A. Spearing, and M. L. Thomas.

ASSOCIATION FRANÇAISE DES TECHNICIENS DU PETROLE.

An invitation is extended to the members of the Institution of Petroleum Technologists to become "Membres Associés" of the Association Française des Techniciens du Pétrole. Applications for admission must be proposed and seconded by two members of the Association and submitted on a Form obtainable from the Secretary, 85, Boulevard du Montparnasse, Paris VIe, or from the Institution offices, Aldine House, Bedford Street, Strand, London, W.C.2.

The annual subscription of a Membre Associé is 50 francs per annum, payable in advance on the 1st January in each year. The annual subscription entitles the member to the receipt of the monthly Bulletin. Subscription to the "Publications" issued at intervals is supplementary.

CHEMICAL ENGINEERING CONGRESS.

London, June 22–27, 1936.

A Chemical Engineering Congress of the World Power Conference will be held at the Central Hall, Westminster, London, from Monday, June 22nd, to Saturday June 27th, 1936.

The following Papers of particular interest to the petroleum industry are scheduled for presentation :—

"Corrosion of Pipe-lines." J. Ph. Pfeiffer and C. A. H. v. Wolzogen Kuhr.

"Benzole Recovery from Coal Gas." G. J. W. Anderson and W. G. Adam.

"Fractionation of Heavy Oils by Solution of Gases." S. Pilat.

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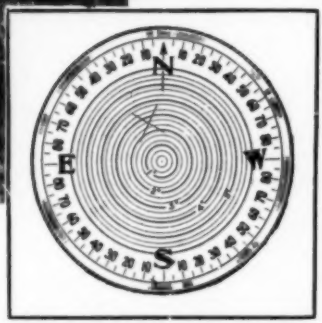

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"Graphical Calculation of Fractionating Columns." Erik Oman.
"Cracking Plants—their Design, and the Desirable Characteristics of Material Employed in their Construction." Gustav Egloff.
"Distillation Developments." G. G. Brown.
"Low-temperature Coal Carbonization." F. Muller.
"Recent Development of Low-temperature Carbonization in Japan." Yoshisada Ban.
"Recent Developments which have Increased the Flexibility of the Phenol Process for the Treatment of Lubricating Oils." R. K. Stratford.
"The Relation between the Qualities of Lubricating Oil and its Chemical Structure." H. I. Waterman.
"Significance of and Relation between the Properties of Lubricating Oils." M. Freund.
"Modern Solvent Extraction in Connexion with Lubricants." R. E. Wilson.
"The Development of an Intermediate Scale Plant for High-pressure Hydrogenation of Tar and Tar Distillates." G. Fraser Shaw and J. G. King.
"The Synthesis of Methanol." Takashi Eguchi.
"The Construction of High-pressure Vessels." R. K. Fieldner.
"Education and Training in the Oil Industry." A. W. Nash.
"Present State of the Standardization of Chemical Apparatus and its Further Development." H. H. Franck.
"The Development of an Industrial Research Station." A. E. Dunstan.

Particulars of membership of the Congress may be obtained from the General Secretary, Mr. M. W. Burt, 56, Victoria Street, London, S.W.1.

The British Chemical Plant Manufacturers Association will hold its periodical Exhibition of British Chemical Plant at the Central Hall, Westminster, during the course of the Congress.

ROYAL SOCIETY OF ARTS.

Thomas Gray Memorial Trust.

The Council of the Royal Society of Arts offer two Prizes of £100 each under the Thomas Gray Memorial Trust for the advancement of the Science of Navigation.

The First Prize will be awarded for an invention which, in the opinion of the Judges, is considered to be an advancement in the Science or Practice of Navigation.

The Second Prize will be awarded for an Essay on the following subject: "*What are your views on the effectiveness or otherwise of Part II of the Merchant Shipping (Safety and Load Line Conventions) Act, 1922, with special reference to vessels engaged in the carriage of oil and timber cargoes, and with particular regard to actual sea experience?*"

Further particulars of these two Prizes may be obtained from the Secretary, The Royal Society of Arts, John Street, Adelphi, London, W.C.2.

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The internal plug of concrete and the Bakelite valve mechanism are readily drilled up into harmless fragments and circulated out of the hole. There are no pieces of metal or other substances left to interfere with coring; to impede further drilling; or to cause deflection of the bit.

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BINDING OF JOURNAL, VOL. 21.

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CONTENTS OF APRIL JOURNAL.

The following are scheduled for inclusion in the April issue of the *Journal* :

Presidential Address. Sir JOHN CADMAN, G.C.M.G., D.Sc.
"Welding Hard-facings on Drilling Tools." J. CUTHILL.
"The Welding of Pressure Vessels." Dr. S. F. DOREY.
"The Use of Welding in Transportation and Storage of Oil." A. C. HARTLEY and A. C. VIVIAN.
"The Training of Electric Welders." W. G. POOLE and R. T. ROLFE.
169th General Meeting.
Annual Report of the Council, 1935.
Report of Annual General Meeting.

LIST OF ADVERTISERS.

	PAGE
ALEXANDER ANDERSON INC.	xi
BABCOCK & WILCOX, LTD.	ix
BAKER OIL TOOLS INC.	xiii
BRITISH BELTING & ASBESTOS, LTD.	xvii
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A. F. CRAIG & CO., LTD.	xix
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HADFIELDS, LTD.	v
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HYDRIL COMPANY	vii
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PATHFINDER PROSPECTING CO.	v
SOCIÉTÉ DE PROSPECTION ELECTRIQUE	xv
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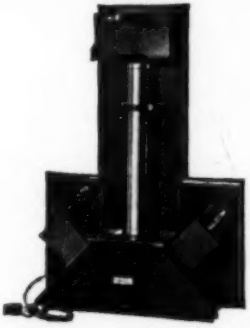

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NOTICES.

The Institution as a body is not responsible for the statements of opinion expressed in any of its publications.

Copyright.—Publication of abstracts of Papers and articles appearing in the Journal is permitted, provided that acknowledgment is made to the Institution of Petroleum Technologists.

Papers and Articles.—The Council invites Papers and Articles both for reading at Ordinary Meetings of the Institution and for publication in the *Journal*. All Papers, whether for reading or publication, will be submitted to a referee appointed by the Publication Committee.

The Institution has published a brochure "Instructions for the Guidance of Authors" containing details of recommended practice in the preparation of Papers for publication. Copies of this brochure will be supplied on request.

Pre-Prints.—Advance proofs of Papers to be read at Ordinary Meetings are generally available about a week before the Meeting. Members wishing to be supplied with these pre-prints are requested to notify the Secretary.

Abstracts.—Members and Journal Subscribers desirous of receiving the Abstracts printed on one side of the paper only, can be supplied with these at a charge of 10*s*. per annum per copy, payable in advance.

Issue of Journal.—Members whose subscription is not in arrear receive the *Journal* free of cost. A member whose subscription is not paid by March 31st of the year for which it is due is considered to be in arrear.

Changes of Address.—Members are requested to notify any change of address to the Secretary.

Benevolent Fund.—The Benevolent Fund is intended to aid necessitous persons who are or have been members of the Institution, and their dependent relatives.

The Fund is raised by voluntary annual subscriptions, donations, and bequests, and all contributions should be sent to the Secretary of the Institution at Aldine House, Bedford Street, London, W.C. 2. The Fund is administered by the Council through the Benevolent Fund Committee, and all applications in connection therewith must be made on a special form which can be obtained from the Secretary of the Institution.

Appointments Register.—A register of members requiring appointments is kept at the offices of the Institution, and every effort is made to assist members of the Institution in search of employment.

Members who desire their names and qualifications to be included in this register are requested to apply to the Secretary for the Form of Application for Registration, if they have not already done so. Members residing in the London area are asked, if possible, to return this Form in person and make themselves known, together with their requirements, to the Secretary. It is also requested that members should notify the Secretary immediately they have obtained an appointment.

In submitting names of candidates to prospective employers it is understood that the Institution accepts no responsibility and gives no guarantee.

Library.—The Institution's Library may be consulted between the hours of 9.30 a.m. and 5 p.m. daily. (Saturdays, 9.30 a.m. to 12 noon.)

INSTITUTION NOTES.

April 1936.

FORTHCOMING MEETINGS.

May 7th–15th, 1936. Meetings in Holland and Germany. Details of these Meetings and travel arrangements have been published separately to all members of the Institution. See also p. iv.

May 15th, 1936. Meeting of members of the Institution in U.S.A. at the Hotel Mayo, Tulsa, Oklahoma. The following addresses have been promised:—

Dr. Gustav Egloff, "**Twenty-five Years of Oil**";
Dr. R. E. Wilson, "**Propane Dewaxing and Deasphalting**";
Mr. E. de Golyer, "**Some Aspects of the Problem of Prospecting for Petroleum.**"

Members wishing to participate in this meeting should communicate with Dr. C. K. Francis, Ph.D., 1221, East 29th Place, Tulsa, Oklahoma, U.S.A.

ANNUAL DINNER.

The Annual Dinner of the Institution will be held on Friday, **9th October, 1936,** at the Connaught Rooms, Great Queen Street, W.C.2.

This early intimation is given so that members can reserve the date. Particulars of the price of tickets, etc., will be circulated later.

STUDENTS' PRIZES.

Papers submitted for the Students' Medal and Prize and for the Students' Prize presented by Mr. T. C. J. Burgess must be received at the Institution not later than **30th September, 1936.**

NEW MEMBERS.

The following have been elected by the Council in accordance with the Bye-Laws since the last issue of the *Journal*. Election or transference is subject, in each case, to confirmation in accordance with Bye-Law Sect. IV, paras. 9 and 10.

Members.

Eyles, Harold Beeching	London.
Fothergill, Hugh Cyril Stanislaus	Manchester.
Maxwell, Douglas Irving	Ploesti.
Perquin, Johannes Nicolaas Jacobus	Dutch East Indies.
Zublin, John Adolphus	Los Angeles.

Students.

Black, John Linton	Teddington.
Cahill, Patrick	London.

Associates.

David, Reginald	London.
Hall, Albert Edward Nichol	Bristol.

CANDIDATES FOR ADMISSION.

The following have applied for admission to the Institution, or transfer to another grade of membership, and in accordance with the Bye-Laws the proposals will not be considered until after the lapse of at least one month subsequent to the issue of this *Journal*, during which any Member or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of any candidate.

The object of this information is to assist the Council in grading candidates according to the class of membership.

The names of the candidate's proposer and seconder are given in each case, except as provided by Bye-Laws, Sect. IV. 3.

ANDREWS, Basil George, Chemical Assistant (*The Central Laboratories, Shell Marketing Company*), 24, Claremont Road, Teddington, Middlesex. (*J. S. Jackson ; J. Parrish.*)

BALDWIN, Reginald Frank Alfred (Trans. : from Associate Member), Consulting Petroleum Technologist, 2, Victoria Mansions, Sumatra Road, W. Hampstead, N.W.6. (*Harold Moore ; C. W. B. Shorto.*)

BOWKER, Thomas Dennis, Laboratory Assistant, c/o The London Oil Refining Co., Lorco Works, Croft Street, Clayton, Manchester, 11. (*J. E. Haslam ; R. Saunsbury.*)

BRAYFIELD, Thomas Henry Gordon, Marine Surveyor, Senior Partner of Carmichael & Clarke, 3, Queen's Building, Hong Kong. (*G. A. O'Neill.*)

CHANEY, Newcomb Kinney, Director of Research, The United Gas Improvement Co., 1401, Arch Street, Philadelphia, Pa., U.S.A. (*J. Bennett Hill ; W. F. Faragher.*)

COOMBER, Stephen Edward (Trans. : from Student), Demonstrator in Oil Technology, Royal School of Mines, " Rydon," St. Johns Avenue, Harlow, Essex. (*V. C. Illing ; P. G. H. Boswell.*)

ENOMOTO, Ryuichiro, Engineer Commander, I.J.N. (*Fuel Dept., Munition Bureau, Imperial Japanese Navy*), 978–2 chome, Denenchofu, Omori-ku, Tokyo, Japan. (*P. E. Joyce.*)

HARRISON, John Leslie, Mechanical Engineer (Inspector of Aero Engines), 26, Friars Road, Cheyles More, Coventry. (*C. Dalley ; R. R. Tweed.*)

HELMORE, William, Wing Commander, Royal Aircraft Establishment (Fuel Research), S. Farnboro', Hants. (*A. W. Nash ; A. E. Dunstan.*)

LAHOCINSKI, Dr. Zygmunt, Chief Chemist, State Petroleum Refinery " Polmin," Drohobycz 2, Poland. (*S. Pilat ; E. Dawidson.*)

SINGH, Jang Bir, Assistant Engineer, Gas Department, The Burmah Oil Co. Ltd., Khodaung, Upper Burma. (*R. C. Parker ; F. E. J. Foxall-Smedley.*)

STEWART, John Malcolm, Research Chemist (*Messrs. Moore & George Ltd.*), 359, Croydon Road, Caterham, Surrey. (*Harold Moore ; R. B. Hobson.*)

WALTON, Albert Dundonald, Sales Manager (*Barrett, Tagant & Gotts, Ltd.*), " Mycotte," Brocknam Lane, Betchworth, Surrey. (*C. W. B. Shorto ; R. F. A. Baldwin.*)

COMMITTEES OF COUNCIL.

The following Committees of the Council were appointed at the Council Meeting held on 6th April, 1936, for the Session 1936–1937 :

The President and Hon. Secretary are ex-officio members of all Committees.

Awards Committee.

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Dr. F. B. Thole.
and Chairmen of various sub-Committees.

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Dr. F. B. Thole.

ARTHUR W. EASTLAKE, *Honorary Secretary.*

MEETINGS IN GERMANY, 12TH–15TH MAY, 1936.

The following additional particulars of the meetings of the Institution in Germany on 12th–15th May, 1936, have been received subsequent to the issue of the Meeting circular :—

Tuesday, 12th May.

Members will be entertained to dinner by the Deutsche Gesellschaft für Mineralölforschung. (President : Prof. Dr. L. Ubbelohde. Director : Dr. Ing. O. Zaepke.)

Wednesday, 13th May.

Prior to the departure from the Hotel Ernst August for Wietze, Mr. K. Grosse, Director of the Fachgruppe Erdolbergbau, will give a short introductory lecture on Petroleum Mining at Wietze.

Members are invited to luncheon at the Casino, Wietze, by invitation of the Deutschen Petroleum A.-G. After luncheon two short lectures will be given as follows :—

Dr. Weller : **"Geology and Chemistry of the Nienhagen Oilfields."**

Dr. Ing. Deicher : **"Technical Features of Drilling on the Nienhagen Field."**

The visit to Nienhagen will include the inspection of the Natural Gas and Gasoline Plant.

Tea will be provided by invitation of the Gewerkschaft Elwerath.

8.0 p.m. Dinner by invitation of the Fachgruppe Erdolbergbau.

THE FACHGRUPPE ERDOLBERGBAU.

The following notes on the organization of the Fachgruppe Erdolbergbau have been kindly supplied for the information of members who are participating in the forthcoming visit to Germany on 12th–15th May.

The Technical Group for Petroleum Mining is a sub-Group of the economic Group "Mining" in the technical structure in which German trade and industry are organized.

The Technical Group for Petroleum Mining is officially appointed to advise and to assist its members on technical matters, taking into consideration the common interests of industrial economics and safeguarding the interests of the State. In addition the technical Group deals with matters pertaining to questions of mining law and tax law, prevention of accidents, etc.

The President of the Fachgruppe Erdolbergbau is Mr. K. Grosse, Wietze (German Petroleum Company, Ltd.). The Business Manager of the Fachgruppe Erdolbergbau is Mr. H. Hubrig, Wietze.

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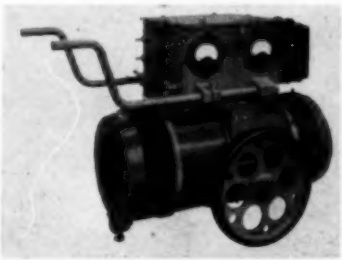

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BRANCH NOTES.

Northern Branch.

A very successful meeting of the Northern Branch was held in Manchester on 20th March, 1936. About 150–200 members and visitors were present. Mr. F. J. Slee, B.A., B.Sc., gave an Address on "Industrial Lubrication," which was followed by a very interesting discussion.

The history of specifications was first traced from the time of the use of fixed oils for lubrication. In the early days a prediction of practical performance was then placed on these various tests, which had persisted from the time of lubrication by fatty oils; thus an endeavour had been made to correlate flash point and carbonization in an engine, which he proposed to show was an entirely erroneous one, and so a false technology of specifications arose.

The usually applied tests, such as specific gravity, flash point, viscosity, setting point and saponifiable matter, were then fully examined, and by actual engine test their true significance, from the point of view of lubrication, was deduced. Amongst other points, the author showed that specific gravity had practically lost all its previous significance with the advent of solvent-extracted oils, and that flash point could not in any way be correlated with tendency to carbonize in an engine. In spite of this knowledge, which is known to the lubricating oil trade, Mr. Slee stated that both in the lubricating oil trade and outside it, there still persisted the old-fashioned ideas on these tests.

If the foregoing is a true picture of the position, it would appear that specifications are of little value, excepting as labels to re-identify a lubricant previously used, but fortunately this was not the case, providing modern specifications were applied.

Rumanian Branch.

The 53rd General Meeting of the Rumanian Branch was held on 6th March, 1936.

Dr. G. Suciu read a most interesting paper entitled "Cracking and Polymerization."

Mr. C. R. Young took the Chair at the meeting, the first occasion on which he has occupied this position, as he has recently taken over the Chairmanship of the Branch for the coming Session from Mr. P. R. Clark.

South Wales Branch.

Sir John Cadman, President of the Institution, addressed a very large meeting of the members of the South Wales Branch and visitors at Llandarcy Refinery on 1st April, 1936. Sir John dealt with the development of the search for oil in Great Britain. The Address was illustrated by a large number of slides and a film.

Mr. W. C. Mitchell, Chairman of the Branch, was in the Chair, and the meeting was also attended by Dr. A. E. Dunstan, Mr. G. H. Coxon and Mr. S. J. Astbury.

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Trinidad Branch.

The 46th General Meeting of the Trinidad Branch was held on 26th February, 1936, at the Apex Club, Fyzabad. Commander H. V. Lavington, R.N., was in the Chair.

Mr. J. L. Harris, M.C., B.Sc., A.R.S.M., A.R.C.S., introduced for discussion the subject of "Present Practice and Future Possibilities of the use of Cement in Oilfield Development." Twenty-two members and guests were present.

The following took part in the discussion: L. A. Bushe, A. F. Castle, H. D. Fletcher, C. A. Moon, H. W. Reid, A. H. Richard, A. J. Ruthven-Murray, E. C. Scott and G. H. Scott.

VISIT TO FUEL RESEARCH STATION.

An invitation has been extended to the members of the Institution of Petroleum Technologists to visit the Fuel Research Station, East Greenwich, S.E. 10, on Tuesday, 9th June, 1936 (2.0 p.m. to 6.0 p.m.). Visitors will be given an opportunity of inspecting the laboratories and large-scale experimental plant, and of obtaining a general insight into the whole range of the Fuel Research work of the Department. The Director of Fuel Research particularly welcomes those who have not previously had an opportunity of inspecting the Fuel Research Station.

Admission will be by card of invitation issued from the Fuel Research Station. Members desirous of participating in this visit should communicate with the Secretary of the Institution of Petroleum Technologists, Aldine House, Bedford Street, Strand, W.C. 2, not later than Saturday, 2nd May, 1936.

PERSONAL NOTES.

Mr. R. Allan has left for Venezuela.
Mr. B. D. Bailey is home from India.
Mr. M. Bramwych is in Iraq.
Mr. C. E. Capito has returned from Trinidad.
Mr. A. R. Code has returned to Australia.
Dr. G. Frischknecht has left for Dutch New Guinea.
Mr. G. W. Halse has returned to Venezuela.
Dr. J. B. Harrison has left for Iran.
Mr. J. L. Lindsay is in Trinidad.
Mr. R. Panisset has returned to Mexico.
Mr. J. Westbury is home from Trinidad.

The Secretary would be glad to learn of the addresses of the following Members:—T. W. Dagg, C. W. Fulcher, D. R. Fyfe, R. E. Goldsbrough, K. B. Harper, T. F. Mason, A. N. K. S. Mohandes, P. E. T. O'Connor, D. J. Pull, K. A. Spearing, and M. L. Thomas.

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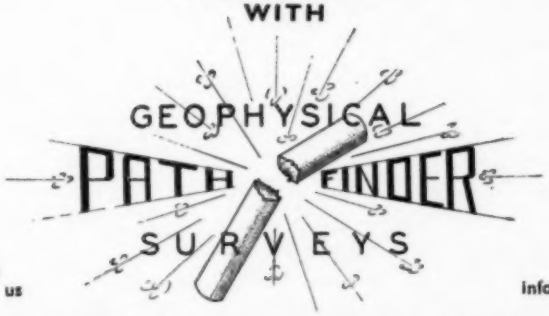

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THE THIRD WORLD POWER CONFERENCE.

Washington, September 1936.

THE Third World Power Conference will be held at Washington in the week of September 12. It differs materially in its general scope and idea from its predecessors.

In the official foreword on the organisation of this meeting it is stated that it seems desirable to centre discussions on the more fundamental problems of the relations of power resources, their development and use, to the social and economic interests of the nation. For that reason the general subject for the meeting is denominated "The National Power Economy," considered in its broadest sense of energy sources, development, and utilization. The subject will be discussed from the point of view of its physical and statistical basis; its technical, economic, and social trends; the relation thereto of the fuel-producing, processing and distribution industries and of electric and gas utilities; practices and policies respecting organization, control, and public regulation; national and regional planning of power development and use; conservation of fuel and water resources; rationalization of the distribution of gas and electricity; and a national power and resources policy.

The programme is divided into seven sections as follows :—

Section I.—"Physical and statistical basis of the national power economy; technical, economic, and social trends." It will include a statistical summary of available national data on power resources and on their development and use; an economic study of trends in such development and use, their causes and effects and their technical, economic, and social significance; a review of the agencies and processes for gathering statistical data; and a discussion of the form and content of such data in the fields of power and power resources, with particular reference to their international use.

Section II.—"Organization of the fuel industries" to include a discussion of the physical and corporate organization for the production, processing, and distribution of solid, liquid, and gaseous fuels; the economic and corporate relations, internal and external, of the fuel industries; the special problems arising from the character of the resource and of the title thereto, from annual and seasonal variations in production, from restrictions on imports and exports and from competition with other fuels and other energy sources; history and status of coal carbonization and hydrogenation and of petroleum production and refining; distribution of use of fuels among classes of consumers and the machinery for effecting distribution; price and production control; consumer and employee relations; and economic and industrial stabilization.

Section III.—"Organization and regulation of electric and gas utilities" to include a discussion of the organization and operation of private and publicly-owned electric and gas utilities from the standpoint of their functions and obligations and dealing with : The consolidation of operating plants into interconnected operating systems and into systems beyond the limits of interconnected

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operation; the methods and agencies of consolidation employed; the problems arising from common ownership or control of private gas and electric utilities and of control of non-utility interests; the nature and extent of regulation exercised by the States through permanent commissions or otherwise; the form and extent of public ownership of gas and electric utilities; the conditions under which publicly-owned utilities are operated; and the position which public ownership and operation occupy in the entire field of gas and of electric-utility service.

Section IV.—" National and regional planning for most efficient utilization of natural resources " to include a review of the history and status of national planning movements; a discussion of the practical limits within which such planning can be accomplished; legal and political barriers; projects which have been undertaken; and the specific relation of such planning to conservation of natural resources, particularly of coal, petroleum, and natural gas.

Section V.—" Special problems in regional planning " to include the application of regional planning to the co-ordinated utilization of water resources for all purposes; the utilization of small water powers; the integration of gas and of electric-utility facilities; technical problems; physical and economic limitations; and economic and social effects.

Section VI.—" Rationalization of distribution " to include methods by which and the economic principles in accordance with which the maximum use of electric energy and of gas may be made available to consumers with adequate service conditions and at minimum cost, while maintaining reasonable return to invested capital and to management, whether private or public; with a discussion of the application of such methods and principles in the field of rural electrification.

Section VII.—" National power and resources policies " to include a summary of the questions of policy discussed in previous sections; extent to which such policies are fixed by legislation or are subject to political change; the degree to which individual policies are co-ordinated into a unified policy; and probable future trends.

Generally speaking the design is to appeal to the layman as well as to the engineer by dealing with national power economy from the point of view of the economic and social consequences of engineering achievement, including problems of organization, planning, management and control. It is desired to avoid papers of a purely technical character and to limit technical discussion beyond what is necessary in the way of explanation or illustration. Papers must be submitted through, or with the approval of, the National Committee, or of the Government of the country from which they emanate.

President Roosevelt is the Honorary President of the Third World Power Conference, the Honorary Vice-President is the United States Secretary for the Interior, Mr. Harold L. Ickes, the Chairman is Mr. William F. Durant, and the Director Mr. O. C. Merrill.

There will be a short tour of about a week, previous to the Conference, and a more extended post-Conference Trans-Continental tour lasting about three weeks.

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INSTITUTION NOTES.

May 1936.

PETROLEUM TECHNOLOGY, 1935.

The Annual Reports on the Progress of Naphthology will be published as a separate volume in June 1936, price 7*s.* 6*d.*, available to members of the Institution and subscribers to the *Journal* at 3*s.* 6*d.*, per copy (postage 6*d.* extra).

These Reports have been an important feature of the Institution's publications since they were initiated in 1924. The work of collecting and assembling some hundreds of references and reviewing the developments in each field of petroleum technology has been undertaken by the Abstracts Sub-Committee of the Council, under the Chairmanship of Dr. F. H. Garner. To the members of this Sub-Committee the Council wish to express an appreciation of their valuable work, which all members of the Institution and readers of the *Journal* will heartily support.

The Reports have previously formed part of the May and June issues of the *Journal*. Owing to the increasing demand on the pages of the *Journal* for contributed Papers and Discussions, the Council has decided to publish the Annual Reports separately. The title of the book has been altered from " Annual Reports on the Progress of Naphthology " to " Petroleum Technology, 1935."

MEMBERSHIP OF COUNCIL.

The Council has elected Mr. C. A. P. Southwell an additional member of the Council under the provision of Bye-Laws, Sect. VII, para. 11.

CANDIDATES FOR ADMISSION.

The following have applied for admission to the Institution, or transfer to another grade of membership, and in accordance with the Bye-Laws the proposals will not be considered until after the lapse of at least one month subsequent to the issue of this *Journal*, during which any Member or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of any candidate.

The object of this information is to assist the Council in grading candidates according to the class of membership.

The names of the candidate's proposer and seconder are given in each case.

BROWN, Esmond Chodwick, Assistant Manager, Motor Oil Sales Dept. (*Messrs. Alexander Duckham & Co., Ltd.*), 68, Queen's Gate, Kensington, S.W.7. (*J. S. S. Brame ; S. E. Bowrey.*)

CAUTHERY, Benjamin David, Refinery Operator, Anglo-Iranian Oil Co., Ltd., Abadan, South Iran. (*J. E. Ford ; C. J. Wright.*)

CONNOCK, Richard Francis, Engineer, c/o United British Oilfields of Trinidad, Ltd., Point Fortin, Trinidad, B.W.I. (*W. G. C. Tomalin ; H. E. Pracy.*)

GIBBS, Reginald Walter, Chemist (*Midland Tar Distillers*), 39, Showell Green Lane, Sparkhill, Birmingham 11. (*A. W. Nash ; C. E. Wood.*)

HUMPHRIES, Albert, Engineer, United British Oilfields of Trinidad, Ltd., Point Fortin, Trinidad, B.W.I. (*W. G. C. Tomalin ; H. E. Pracy.*)

KESSEN, Henry Essler, Director (*Exchange Oil Co., Ltd.*), "Invergarry," Far Moss Road, Blundellsands, Lancs. (*F. C. Baker ; W. Smellie.*)

LESOURD, Olivier, Technical Editor ("*Guide du Petrole*" *etc.*), 3bis, Rue Roussel, Paris. (*Ashley Carter ; C. T. Longcroft.*)

MITCHELL, Norman, Engineer, c/o Asiatic Petroleum Co., Ltd., St. Helen's Court, Great St. Helens, E.C.3. (*J. Kewley ; C. H. Barton.*)

NEW MEMBERS.

The following elections were made by the Council in accordance with Bye-Law, Section IV, para. 7, at the Council Meeting held on the 15th May, 1936.

Elections are subject to confirmation in accordance with Bye-Law, Section IV, paras. 9 and 10.

Members.

COWLISHAW, Geoffrey E.	Leeds.
DEKKER, Jan Arie	Rumania.
FISCHER, Raoul Konrad	London.
FUCHS, George Hugo von	Illinois.
GLENDINNING, Donald Macleod	Heswall.
MACKILLIGAN, Robert Springett	London.
PRIKEL, Gottfried	Rumania.
ROEGIERS, Michel	Belgium.
WOOD-MALLOCK, James Campbell	Wirral.

Transfer to Members.

ANFILOGOFF, Nicholas Lionel	London.
GRAY, Kenneth Washington	London.

Associate Members.

HANCOCK, James Gordon	Wirral.
HOPKINSON, James	Iraq.
MACNIVEN, Hugh	Iraq.
SKILLING, Norman Lillie	Preston.
STRINGER, Norman Reginald	Bramhall.

Students.

DEWAR, Keneth George Outram Deas	Bedford.
JAFAR, Dhya Ul-Deen	Birmingham.
TAYLOR, Theo Mallinson	London.

Associate.

INGRAM, Maurice	Wirral.

ARTHUR W. EASTLAKE,
Honorary Secretary.

CHEMICAL ENGINEERING CONGRESS.

22*nd*–27*th* JUNE, 1936.

The Chemical Engineering Congress of the World Power Conference which is to be held in the Central Hall, Westminster, from 22nd June to 27th June next, is of particular interest to the Petroleum Industry. It may be said that the Petroleum Industry has its own peculiar and private problems, but technical questions have a habit of over-lapping into other domains in a most purposeful way. The Chemical Engineering Congress, however, not only ministers to the special technical needs of the industry, but also provides that wide viewpoint without which progress is liable to be stunted.

Amongst the papers of special interest to our readers we may mention a comprehensive paper by Egloff and Nelson, on the design, operation, and construction of cracking plants; Wilson, Haylett and Keith's contribution on modern solvent extraction in connection with lubricants; Hunter and Nash's paper on the design of solvent extraction units for refining lubricating oil; and a Canadian paper by R. K. Stratford on recent developments of the phenol process for treating lubricating oils. A Polish paper, by Dr. S. Pilat, describes the fractionations of heavy oils by means of solutions of gases, and a Dutch paper, by H. I. Waterman, discusses the relation between the qualities of a lubricating oil and its chemical structure. Professor Nash deals with education and training in the oil industry, and Dr. Dunstan lays down the lines to be followed in the development of an industrial Research Station. In the sections which cover "Separation" and "Heat Exchange" there are numerous papers which treat of problems relating to distillation, contacting equipment, the technology of rectification, graphical computations for the separation of ternary mixtures, the use of filter-presses, the graphical calculation of plate columns and so on.

It would be hard indeed to find a more comprehensive or as complete a treatment of the very thorny problems involved in the choice of constructional materials to resist corrosion than that provided by the papers in Section A, whilst the corrosion of pipe-lines, recent advances in refractory materials, and the lagging of pipe-lines are discussed in this and the following Sections. Obviously, it is impossible to attempt to review all the 121 papers which are to be presented before the Congress, but it should be pointed out that another Section of interest to the Petroleum Technologist is Section H, which covers "High-Pressure Reactions and High Vacua." Here, Professor Gaede gives a valuable account of high-vacuum technology, Dr. Fieldner describes American practice in the construction of high-pressure vessels, various British authorities deal with hydrogenation and other high-pressure reactions, and two Japanese authors describe respectively the present situation of high-pressure chemical industries in Japan and Japanese experience in the manufacture of synthetic methanol.

The subjects of the disposal of effluents, safety, education and training are also covered, and instructive contributions treat of chemical engineering projects, cost analysis, control by statistical

methods, and so on. But enough has been said to show the wide range and the importance of the Congress, and with such a programme it is hoped that when the many foreign members arrive they will be welcomed by a numerous band of British colleagues, which will include such a proportion of Petroleum Technologists as to provide a further numerical demonstration of the importance and wide outlook of the petroleum industry.

PROVISIONAL TIME TABLE.

Monday, 22nd June.

Afternoon : Official Opening of the Congress.
Evening : Reception.

Tuesday, 23rd June.

Morning : Section A—Ferrous Metals in Chemical Plant Construction.
Section B—Refractories, Rubber, Plastics and Other Materials in Chemical Plant Construction.
Afternoon : Section C—Separation.
Section D—Size Reduction, Grading and Mixing; Electrolysis and Electrical Applications.
Evening : Free.

Wednesday, 24th June.

Morning : Section E—Destructive Distillation.
Section F—Treatment and Disposal of Effluents and Waste Materials; Lubrication.
Afternoon : Works' Visits.
Evening : Reception.

Thursday, 25th June.

Morning : Section G—High-Pressure Reactions and High Vacua.
Section H—Heat Exchange.
Afternoon : Works' Visits.
Evening : Official Banquet.

Friday, 26th June.

Morning : Section J—Education and Training.
Section K—Statistics; Administration; Safety and Welfare.
Afternoon : Section L—Trend of Development.
Section M—General Aspects.
Evening : Reception.

Saturday, 27th June.

Morning : Closing Meeting.

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IIe CONGRES MONDIAL DU PETROLE.

Circular No. 2 referring to the Second World Petroleum Congress, is included with the present issue of the *Journal*.

The Congress will be held in Paris from 14th to 19th of June, 1937. The subjects to be discussed under each of the five Sections in which the Programme is organized are given in detail in the Circular.

A very interesting series of Excursions has been arranged by the Organizing Committee both preceding and following the Congress. Prior to the Congress, an excursion will be made to Morocco, which will include one week in that country. On the return from Morocco a further tour will be made in the south of France, to include the refineries of Provence and a visit to the Cote d'Azur.

On the conclusion of the Congress three tours will be arranged as follows :—

(*a*) Refineries of the lower Seine area.
(*b*) Refineries and other works in the north of France.
(*c*) Pechelbronn, Nancy, Strasbourg and the Vosges.

Registration for the Congress should be made as early as possible to the Secretaire General, 85, Boulevard du Montparnasse, Paris (6e).

PAPERS ON DIESEL SUBJECTS.

Pre-prints of the following papers on Diesel Fuels and Engines, recently presented at the meeting of the Institution in Holland, are available to members on application :—

(1) **"The Correlation of Tests on the Ignition Quality of Diesel Fuels, carried out at Delft and Sunbury,"** by Ir. G. D. Boerlage, Ir. J. J. Broeze, L. J. Le Mesurier and R. Stansfield.
(2) **"Diesel Rail Transport in the Netherlands,"** by Ir. W. Hupkes.
(3) **"The Design of Injectors for Diesel Engines,"** by Ir. G. J. Lugt.
(4) **"Specification for Diesel Fuels,"** by C. H. Barton.

Written contributions to the discussion on any of these papers are invited, but must be received at the Institution offices not later than 6th June, 1936.

BRANCH NOTES.

Iranian Branch.

Mr. E. I. Waterhouse presented a paper to the Iranian Branch at Abadan, on 18th March, 1936, entitled "The North-West Iran Project."

Mr. Waterhouse dealt with the reason for the choice of the Naft-i-Shah and Kermanshah sites. This was followed by a brief summary of the plant, machinery, etc., required for the project. He described the laying of the Pipe Line and the difficulties encountered during construction, *e.g.* difficult country and indifferent roads which hampered the movement of material, scarcity of labour, particularly skilled labour, and the all-important problems of food and water.

The discussion which followed was helped considerably by the contributions of those present who had taken some part in the

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development of the scheme. The lecture was illustrated by aerial and other photographs on the Epidiascope recently purchased by the Branch. The meeting was open to the public and about 120 persons attended.

Burma Branch.

The Fifth Ordinary Meeting of the Branch was held on 13th March, 1936, at the Volunteer Club, Yenangyaung, under the Chairmanship of Mr. J. A. Butlin.

Mr. E. W. Bentley delivered a paper on "The Hard Facing of Oil Well Tools." This was illustrated by a series of seventy photographs displayed by the newly purchased Epidiascope and was followed by a keen discussion. Forty-eight persons were present at the meeting.

PERSONAL NOTES.

Mr. R. Allan has returned to Venezuela.

Mr. F. A. Couse is home from India.

Mr. J. C. Daniels is home from the Gold Coast.

Mr. H. T. Lorne is in Iran.

Mr. A. R. Perks has returned from Iraq.

Mr. M. R. H. Porter has returned to Trinidad.

Mr. T. G. Robson has left Burma and is now in Upper Assam.

Mr. C. V. Rutherford is home from Iran.

Mr. F. C. Waters has returned from Iran.

The Secretary would be glad to learn of the addresses of the following members :—T. W. Dagg, C. W. Fulcher, D. R. Fyfe, R. E. Goldsbrough, T. F. Mason, A. N. K. S. Mohandes, D. J. Pull, K. A. Spearing, and M. L. Thomas.

LIST OF ADVERTISERS.

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INSTITUTION NOTES.

JUNE 1936.

TIME OF MEETINGS.

THE Council recently invited members resident in the London Postal area and the Home Counties to express their views regarding the most convenient time for meetings at the Royal Society of Arts.

One hundred and ten replies were received. Fifty per cent. of these were in favour of continuing the present practice of commencing the meetings at 5.30 p.m. More than seventy-five per cent. were in favour of commencing not later than 6 p.m.

Whilst regretting the disappointment and inconvenience which may be caused to those members who have a considerable distance to travel to the meetings at the Royal Society of Arts, it is evident that the wishes of the majority must be observed.

The arrangements for meetings during the Session 1936–37 will, therefore, remain as in previous years, and the meetings will commence at 5.30 p.m.

APPLICATION FORMS.

Copies of Form "A" (Application for admission to the Institution), incorporating the alterations in the method of election approved at the Annual General Meeting in March 1936, are now available. They may be obtained from the Secretary of the Institution or from the Hon. Secretaries of the Branches. The names and addresses of the Branch Hon. Secretaries are given below :—

Burma Branch.	C. E. KEEP, c/o British Burmah Petroleum Co., Ltd., Yenangyaung, Upper Burma.
Iranian Branch.	R. G. BROWN, c/o Anglo-Iranian Oil Co., Ltd., Abadan, South Iran.
Northern Branch.	J. E. BENNION, Sunlight House, Quay Street, Manchester.
Rumanian Branch.	C. R. YOUNG, Teleajen, Ploesti, Rumania.
South Wales Branch.	E. THORNTON, c/o National Oil Refineries, Ltd., Llandarcy, Skewen, S. Wales.
Trinidad Branch.	H. W. REID, c/o Petroleum Office, San Fernando, Trinidad, B.W.I.

CANDIDATES FOR ADMISSION.

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KESSEN, Henry Essler, Director (*Exchange Oil Co., Ltd.*), "Invergarry," Far Moss Road, Blundellsands, Lancs. (*F. C. Baker ; W. Smellie.*)

LESOURD, Olivier, Technical Editor ("*Guide du Petrole*" *etc.*), 3bis, Rue Roussel, Paris. (*Ashley Carter ; C. T. Longcroft.*)

MITCHELL, Norman, Engineer, c/o Asiatic Petroleum Co., Ltd., St. Helen's Court, Great St. Helens, E.C.3. (*J. Kewley ; C. H. Barton.*)

ARTHUR W. EASTLAKE,
Honorary Secretary.

BRANCH NOTES.

TRINIDAD BRANCH.

The 48th General Meeting of the Trinidad Branch was held on 29th April at the Apex Club, Fyzabad. Mr. G. A. Walling, B.Sc., read a paper entitled "The Performance of Direct Gas Operated Plunger Units."

Thirty-three Members and guests were present, and an excellent discussion followed the reading of the Paper. Commander H. V. Lavington, R.N., took the Chair.

PERSONAL NOTES.

Dr. A. WADE, D.Sc., F.G.S. (Member of Council), has been appointed a member of the technical committee appointed to advise the Commonwealth Government on the administration of a Fund to promote the search for petroleum in Australia.

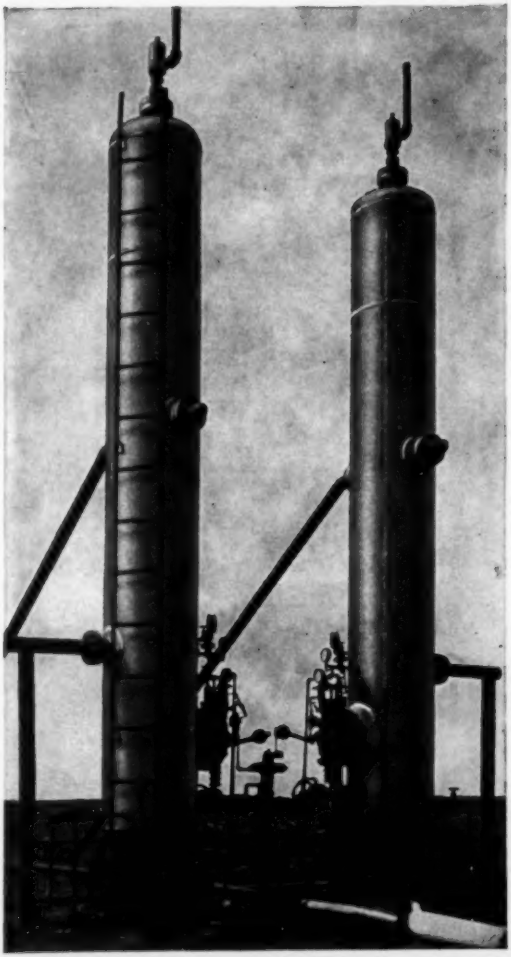
Mr. W. J. BAKER has returned from Iran.

Mr. W. M. CATCHPOLE is home from Iran.

Mr. A. F. CHRISMAN has left for India.

Mr. G. COTTON is home from Burma.

NATIONAL OIL AND GAS SEPARATORS



The two 30 in. × 18 ft. National Oil and Gas Separators on the large gas well in Oklahoma.

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Mr. T. G. B. DAVIES has returned to Burma.
Dr. J. A. L. HENDERSON has left for Canada and the U.S.A.
Mr. C. F. C. MOORE has returned to India.
Mr. J. McV. T. MORESBY has left for India.
Mr. F. G. RAPPOPORT is home from Venezuela.
Mr. H. M. SALE has returned from India.
Mr. F. S. SMITH is home from Mexico.
Mr. L. B. SWEETLAND has returned from D.W.I.

The Secretary would be glad to learn of the addresses of the following Members :—T. W. DAGG, C. W. FULCHER, D. R. FYFE, R. E. GOLDSBROUGH, T. F. MASON, W. T. MENDELL, A. N. K. S. MOHANDES, D. J. PULL, K. A. SPEARING, and M. L. THOMAS.

CONTENTS OF JULY JOURNAL.

The July issue of the Journal will contain the Papers on Diesel Fuels and Engineering presented at the recent meeting of the Institution in Holland, together with a full report of the Meeting.

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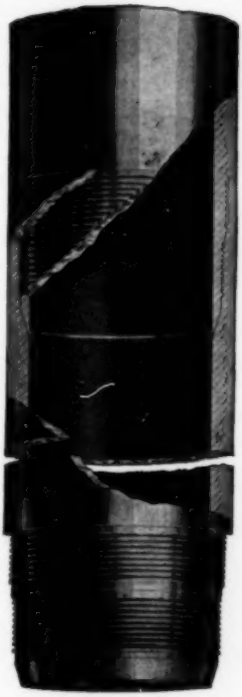

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NOTICES.

The Institution as a body is not responsible for the statements of opinion expressed in any of its publications.

Copyright.—Publication of abstracts of Papers and articles appearing in the Journal is permitted, provided that acknowledgment is made to the Institution of Petroleum Technologists.

Papers and Articles.—The Council invites Papers and Articles both for reading at Ordinary Meetings of the Institution and for publication in the *Journal*. All Papers, whether for reading or publication, will be submitted to a referee appointed by the Publication Committee.

The Institution has published a brochure "Instructions for the Guidance of Authors" containing details of recommended practice in the preparation of Papers for publication. Copies of this brochure will be supplied on request.

Pre-Prints.—Advance proofs of Papers to be read at Ordinary Meetings are generally available about a week before the Meeting. Members wishing to be supplied with these pre-prints are requested to notify the Secretary.

Abstracts.—Members and Journal Subscribers desirous of receiving the Abstracts printed on one side of the paper only, can be supplied with these at a charge of 10s. per annum per copy, payable in advance.

Issue of Journal.—Members whose subscription is not in arrear receive the *Journal* free of cost. A member whose subscription is not paid by March 31st of the year for which it is due is considered to be in arrear.

Changes of Address.—Members are requested to notify any change of address to the Secretary.

Benevolent Fund.—The Benevolent Fund is intended to aid necessitous persons who are or have been members of the Institution, and their dependent relatives.

The Fund is raised by voluntary annual subscriptions, donations, and bequests, and all contributions should be sent to the Secretary of the Institution at Aldine House, Bedford Street, London, W.C. 2. The Fund is administered by the Council through the Benevolent Fund Committee, and all applications in connection therewith must be made on a special form which can be obtained from the Secretary of the Institution.

Appointments Register.—A register of members requiring appointments is kept at the offices of the Institution, and every effort is made to assist members of the Institution in search of employment.

Members who desire their names and qualifications to be included in this register are requested to apply to the Secretary for the Form of Application for Registration, if they have not already done so. Members residing in the London area are asked, if possible, to return this Form in person and make themselves known, together with their requirements, to the Secretary. It is also requested that members should notify the Secretary immediately they have obtained an appointment.

In submitting names of candidates to prospective employers it is understood that the Institution accepts no responsibility and gives no guarantee.

Library.—The Institution's Library may be consulted between the hours of 9.30 a.m. and 5 p.m. daily. (Saturdays, 9.30 a.m. to 12 noon.)

INSTITUTION NOTES.

JULY 1936.

BRANCH CONFERENCE.

A CONFERENCE of Chairmen and Hon. Secretaries of Branches and Members of the Council was held in London on Tuesday, 30th June. Mr. C. Dalley (Chairman of the Branch Committee of the Council), presided over a luncheon-meeting at the Abercorn Rooms, E.C.2. The following representatives of the Branches of the Institution were present :

Comm. H. V. Lavington	(Chairman, Trinidad Branch).
Mr. W. C. Mitchell	(Chairman, S. Wales Branch).
Mr. G. W. Lepper	(Past-Chairman, Burmah Branch).
Mr. E. Thornton	(Hon. Sec. S. Wales Branch).
Mr. C. V. Rutherford	(Hon. Sec. Iranian Branch).
Mr. J. E. Bennion	(Hon. Sec. Northern Branch).
Dr. G. Egloff	(U.S.A.).

A number of matters regarding the policy of the Branches was discussed and recommendations were made for the consideration of the Council.

At the subsequent Council Meeting held on 9th July it was decided that the Chairmen of Branches be invited to Council Meetings and receive copies of the Minutes and Papers under discussion.

Approval was also given to the establishment of an Annual Lecture given in the first instance in London and repeated before the Northern and S. Wales Branches; and to the inauguration of a Prize to be awarded annually for the most meritorious Paper presented to any Branch of the Institution.

NEW MEMBERS.

The following have been elected by the Council in accordance with the Bye-Laws since the last issue of the *Journal*. Election or transference is subject, in each case, to confirmation in accordance with Bye-Law Sect. IV, paras. 9 and 10.

Members.

BRAYFIELD, Thomas H. G.	Hong Kong.
CHANEY, Newcomb Kinney	Philadelphia.
CONNOCK, Richard Francis	Trinidad.
ENOMOTO, Ryuichiro	Tokyo.
HELMORE, Wing-Comm. W.	Farnborough.
LAHOCINSKI, Dr. Zygmunt.	Poland.
MITCHELL, Norman	London.

Transferred to Member.

BALDWIN, Reginald F. A.	London.

Associate Members.

BROWN, Esmond Chadwick	London.
CAUTHERY, Benjamin David	Abadan.
GIBBS, Reginald Walter	Birmingham.
HUMPHRIES, Albert	Trinidad.
SINGH, Jang Bir	Burma.
STEWART, John Malcolm	London.

Transferred to Associate Member.

COOMBER, Stephen Edward	London.

Students.

ANDREWS, Basil George	London.
BOWKER, Thomas Dennis	Manchester.

Associates.

HARRISON, John Leslie	Coventry.
LESOURD, Olivier	Paris.
WALTON, Albert Dundonald	London.

CANDIDATES FOR ADMISSION.

The following have applied for admission to the Institution, or transfer to another grade of membership, and in accordance with the Bye-Laws the proposals will not be considered until after the lapse of at least one month subsequent to the issue of this *Journal*, during which time any Member or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of any candidate.

The object of this information is to assist the Council in grading candidates according to the class of membership.

The names of the candidate's proposer and seconder are given in each case, except as provided by Bye-Laws, Sect. IV. 3.

Candidates for Admission.

BLACK, Alexander Wylie, Marine Surveyor, Carmichael & Clarke, 3, Queen's Building, Hong Kong.

BREY de, Jan Heinrich Christoph, Engineer (*Bataafsche Petroleum Maatschappij*), 49, Prins Mauritslaan, The Hague, Holland. (*J. Kewley ; A. E. Dunstan.*)

CLIFFORD, Guy, Accountant, The Bahrein Petroleum Co., Ltd., Bahrein Island, Persian Gulf.

CURRIE, James Leslie, Engineer (*Valvoline Oil Company*), Tynwald, Hatherley Avenue, Great Crosby, Lancs. (*J. Smith ; A. W. Cox.*)

DAVID, William Anker Lewis, Chemist (*Shell Central Laboratories*), 63, Hazlewell Road, Putney, S.W.15. (*J. S. Jackson ; J. Parrish.*)

LAZIAN, Galena, Mrs., Chemist (*R.O.P., Ltd.*), 78, Gilling Court, Belsize Grove, Hampstead, N.W.3. (*Harold Moore ; R. B. Hobson.*)

LUSTY, Ivor, Engineer (*Rolls-Royce, Ltd.*), 241, Osmaston Park Road, Derby.

MCKEE, John Lockhart, Chemist, Bahrein Petroleum Co., Bahrein Island, Persian Gulf. (*F. H. Garner.*)

PENNY, Basil, Clerk (*C. C. Wakefield & Co.*), 66, Eaton Park Road, Palmers Green, N.13. (*E. A. Evans ; G. H. Thornley.*)

PETRIKEVITCH, Nicolas, Manager & Chief Chemist (*R.O.P., Ltd.*), 99, Broadhurst Gardens, N.W.6. (*Harold Moore ; R. B. Hobson.*)

POUND, Gerald Stephen, Chemist (*Low Temperature Carbonisation, Ltd.*), "Trentham," Whitehall Avenue, Barnsley, Yorks. (*Harold Moore ; R. B. Hobson.*)

SLEIGHT, Glenn Coutes, Geologist (*Michigan Geological Survey*), P.O. Box 133, Mount Pleasant, Michigan, U.S.A. (*Dr. R. Stern ; J. O. Guthrie.*)

SMITH, Norman Wilson, Chemist (*G. Watson Gray*), 17, Groes Road, Liverpool, 19. (*J. Smith ; A. W. Cox.*)

TILLING, Arthur Henry Gwynne, Refinery Operator (*Lobitos Oilfields, Ltd.*),

"Roseneath," Bedford Avenue, Whitby, Ellesmere Port, Wirral. (*F. Mackley ; V. Biske.*)

WATSON, Archibald, Secretary (*John W. Miller & Sons, Ltd.*), "Braemar," Crowtrees Lane, Brighouse, Yorks. (*W. H. Huxley; H. C. Tett.*)

WARD, Percy James, Chemist (*Attock Oil Co., Ltd.*), 388, Edgware Road, W.2. (*T. T. McCreath ; A. W. Nash.*)

WEBSTER, William Armstrong, Engineer (*Texas Oil Co., Ltd.*), "Ashbrooke," Park Gates Drive, Cheadle Hulme, Cheshire. (*N. A. Anfilogoff ; W. E. Gooday.*)

Candidates for Transfer.

BALLET, Jacques, Chemist (Trans. from Associate Member), Standard Franco-Americaine de Raffinage, Raffinerie de Port-Jerome, Seine-Inferieure, France. (*F. H. Garner ; H. E. Thomas.*)

EVANS, Arthur (Trans. from Student), Chemist (*Coal & Allied Industries, Ltd.*), 4, Sebastopol Terrace, Seaham Harbour, Co. Durham. (*V. C. Illing ; T. Cohn.*)

HOWES, Donald Albert (Trans. from Associate Member), Chemist, Anglo-Iranian Oil Co., P.O. Box 1, Chertsey Road, Sunbury-on-Thames. (*F. B. Thole ; C. V. Hill.*)

RENDEL, Terence Blair (Trans. from Associate Member), Engineer, Shell Petroleum Corp., Wood River, Illinois, U.S.A. (*J. Kewley ; C. H. Barton.*)

ROBSON, Thomas Gordon (Trans. from Student), Production Engineer, Assam Oil Co., Digboi P.O., Upper Assam. (*R. Harcus ; E. T. Vachell.*)

WATTS, Harry Temple (Trans. from Associate Member), Drilling Superintendent, Anglo-Iranian Oil Co., Britannic House, Finsbury Circus, E.C.2. (*H. W. Lane ; H. S. Gibson.*)

ARTHUR W. EASTLAKE,
Honorary Secretary.

MEETING IN TULSA.

The first meeting of members of the Institution resident in the United States was held in Tulsa, Oklahoma, on 15th May, 1936.

Dr. C. K. Francis presided over a dinner held at the Hotel Mayo, which was attended by about seventy technologists, of whom seventeen were members of the Institution.

Following the dinner, an Address was given by Dr. G. Egloff, who spoke on "Twenty-five Years in Oil." After referring to the history and development of the Institution, Dr. Egloff described the newest developments in the field of polymerization, and envisaged the future in which it would be possible to produce single hydrocarbons for specific uses.

Mr. E. R. de Golyer, Past-President of the American Association of Petroleum Geologists, followed with a very interesting talk on "Prospecting for Petroleum." Mr. de Golyer referred to the assistance which was now being given to the geologist by the related sciences of geophysics, palæontology, physics and mathematics in the search for new fields.

At the conclusion of the dinner it was decided to form a small Committee, of which Mr. B. C. Frichot is Chairman, to discuss whether this very successful meeting should be made an annual function.

BRANCH NOTES.

BURMA BRANCH.

The Sixth General Meeting of the Branch was held on 8th May, 1936, at the Volunteer Club, Yenangyaung. Mr. W. E. V. Abraham was in the Chair.

Mr. J. Coates, A.M.Inst.P.T., presented a paper on "Repressuring" illustrated by a number of diagrams. Approximately forty members and visitors were present, and the paper was followed by a keen discussion.

Rumanian Branch.

The following Committee of the Rumanian Branch has been elected for the year 1936–37 :

Chairman : C. R. Young.

Ex-officio members : J. L. Chaillet, P. R. Clark, I. Edeleanu, E. C. Masterson, D. I. Maxwell, I. S. Rutherford.

Hon. Treasurer : Capt. J. E. Treacy.

Hon. Secretary : O. A. Bell.

NORTHERN BRANCH.

The members of the Northern Branch paid a very enjoyable visit to Ellesmere Port, Cheshire, on Wednesday, 17th June. By courtesy of the Lobitos Oilfields, Ltd., an inspection was made of their recently opened Refinery.

The main feature of the Refinery is the distillation plant comprising two separate units which may be operated independently or in conjunction with one another. One unit works under atmospheric pressure, and on this unit the benzine, kerosine, and gas oil are distilled from the crude oil by multiple flash vaporization and careful fractionation in individual towers. The residual oil from this unit when processing crude for lubricating oils is picked up hot and pumped to the second unit, which works at about 40 mm. absolute pressure in the fractionating column. This unit cuts from the residual oil five lubricating oil fractions, and leaves as residue a bitumen which can be controlled to any of the standard penetrations.

Mr. J. S. Parker, Refinery Manager, gave the visitors a short introductory talk on the processes carried out in the Refinery.

From the Lobitos Refinery the party proceeded to the Oil Dock of the Manchester Ship Canal and visited the tank farm at Stanlow. Mr. E. J. Dunstan, Manager of the Refinery of Shell-Mex & B.P., Ltd., at Stanlow, received the visitors and demonstrated the construction and arrangement of the storage tanks.

About seventy members of the Branch participated in this visit.

STUDENTS' SECTION (LONDON BRANCH).

The following have been elected members of the Committee of the Students' Section (London Branch) for the Session 1936–37 :—

R. H. Keach (*Chairman*); G. M. Barrett (*Vice-Chairman*); W. R. Wright; W. R. Boyd; P. E. Groves; H. E. W. Kirby; A. S. Bridgwater; Ashley Carter (*Representative of Council*); B. C. Ferguson (*Hon. Secretary*).

INSTITUTION NOTES.

AUGUST 1936.

ANNUAL DINNER.

The Annual Dinner of the Institution will be held on Friday, 9th October, 1936, at the Connaught Rooms, Great Queen Street, Kingsway, W.C.2.

Particulars of the price of tickets, etc., will be circularised to members early in September.

STUDENTS' PRIZES.

Papers submitted for the Students' Medal and Prize and for the Students' Prize presented by Mr. T. C. J. Burgess, must be received at the Institution not later than 30th September, 1936.

Particulars of the regulations for both prizes may be obtained from the Secretary of the Institution.

ARTHUR W. EASTLAKE,
Honorary Secretary.

PERSONAL NOTES.

Mr. J. R. CASE is home from Burma.
Mr. G. DICKINSON has returned from Venezuela.
Mr. S. M. HANNAN is in South Africa.

The Secretary would be glad to learn of the addresses of the following Members: D. R. FYFE, R. E. GOLDSBROUGH, T. F. MASON, W. T. MENDELL, A. N. K. S. MOHANDES, D. J. PULL, K. A. SPEARING, A. W. THOMPSON, and M. L. THOMPSON.

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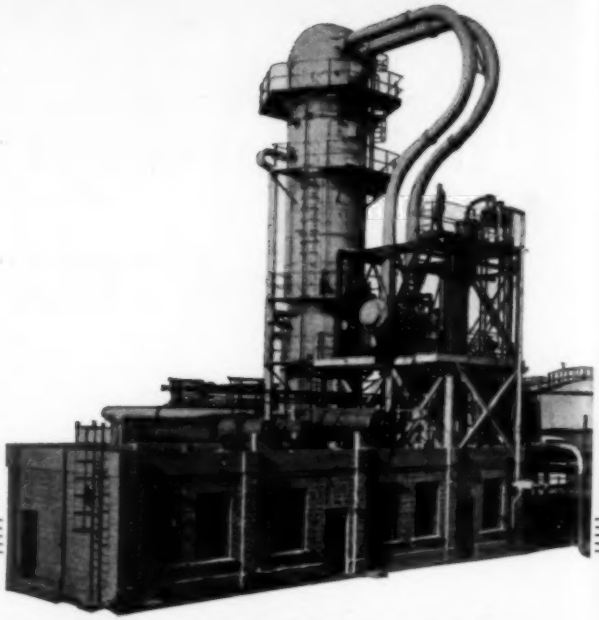

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INSTITUTION NOTES.

SEPTEMBER 1936.

PROGRAMME.

OCTOBER–DECEMBER, 1936.

Thursday, October 8th, at the Chemical Society, Burlington House, Piccadilly, London, at 5.45 p.m. (Tea and light refreshments, 5.15 p.m.)

A series of short papers by delegates of the Association Française des Techniciens du Pétrole.

Friday, October 9th, at the Connaught Rooms, Great Queen Street, Kingsway, London, at 7 p.m. for 7.30 p.m.

Annual Dinner.

Price of tickets, 12*s.* 6*d.* each, exclusive of wines. (Student Members, 7*s.* 6*d.* each.)

Tuesday, November 10th, at the Royal Society of Arts, John Street, Adelphi, London, at 5.30 p.m.

Symposium of papers on "Geophysics." Papers will be presented by Dr. J. H. Jones and Mr. R. Davies, M. Schlumberger and A. A. Perebinosoff, and Dr. E. E. Rosaire.

Tuesday, December 8th, at the Royal Society of Arts, John Street, Adelphi, London, at 5.30 p.m.

Open discussion on "The Organization of Research in the Petroleum Industry." Introductory papers will be read by Mr. Vermuelen and Mr. D. A. Shepard.

STUDENTS' PRIZES.

Papers submitted for the Students' Medal and Prize and for the Students' Prize presented by Mr. T. C. J. Burgess, must be received at the Institution not later than **30th September, 1936.**

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BRANCH NOTES.

Northern Branch.

Tentative Programme.

1936–37.

October 21st, 1936.	"Diesel Engines and Diesel Oils." By Dr. Wheeler, M.A., F.I.C., F.C.S.
November 18th, 1936.	"Interesting Applications of Petroleum." By Mr. C. Chilvers, B.Sc., F.I.C., F.C.S.
December 16th, 1936.	"High Performance Fuels." By Mr. H. C. Tett, B.Sc., D.I.C., A.R.C.S.
January 20th, 1937.	"Kerosine, Its Glorious Past and Future Prospects." By Mr. J. Kewley, M.A., F.I.C., F.C.S. (Joint Meeting with the Oil & Colour Chemists' Assoc.)
February 17th, 1937.	"Engine Testing." By Mr. H. R. Ricardo, B.A., M.I.A.E., F.R.S.
March 5th, 1937.	"Industrial Solvents." By Mr. Harrop, F.I.C. (Joint Meeting with the I.R.I., S.C.I., and Chemical Society.)

CANDIDATES FOR ADMISSION.

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The object of this information is to assist the Council in grading candidates according to the class of membership.

The names of the candidate's proposer and seconder are given in each case, except as provided by Bye-Laws, Sect. IV. 3.

Butler, Cyril Dean, Lecturer in Petroleum Technology, 29, High Street, London, N.W.3. (*J. S. Jackson ; J. Parrish.*)

Ballardie, Alfred William, Naval Architect, 3, Savoy Place, Victoria Embankment, London, W.C.2. (*W. J. Wigney ; C. W. Wood.*)

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CHAPELLE, Ernest Benjamin, Engineer (*Messrs. Henry Balfour, Fife*), 38, Bayview Crescent, Methel, Fife. (*J. McConnell Sanders ; F. H. Garner.*)

DAWIDSON, Emanuel (Trans. from Associate Member), Refinery Manager, S.A., "Gazy Ziemne," Iwow-Zniesienie, Poland. (*A. E. Dunstan ; S. Pilat.*)

EVANS, Stanley Hugh, Chemist, c/o Commonwealth Oil Refineries, Laverton, Box 6, Williamstown W.16, Melbourne, Victoria, Australia. (*G. F. McKillop ; E. W. Sheel.*)

FREWING, Joseph John, Chemist, Tudor Cottage, Cookham Dean, Berks. (*J. S. Jackson ; J. Parrish.*)

GOODEY, John Hill, Chemist, Shell Co. of Australia, William Street, Melbourne, Australia. (*L. F. Elsby ; C. L. Carter.*)

HEPWORTH, Anthony Morice, Refinery Superintendent (*Berry Wiggins & Co.*), 21, Vestris Drive, Wilton Road, Pendleton, Salford 6, Lancs. (*R. C. Paterson ; W. W. Watt.*)

HOOPER, Leslie Frank, Engineer (*Anglo-Iranian Oil Co.*), St. Hilda, Langland Road, Mumbles, Nr. Swansea. (*W. C. Mitchell ; A. E. Holley.*)

KESSEN, Henry Essler, Director (*Exchange Oil Co., Ltd.*), "Invergarry," Far Moss Road, Blundellsands, Lancs. (*F. C. Baker ; W. Smellie.*)

LAUNY, Sverre, Chief Chemist, The Norwegian-American-Mineral-Oil Company, Vallo, nr. Tonsberg, Norway. (*F. H. Garner ; C. Chilvers.*)

NABUCO, C. E. de Araujo Jor, Chemist, Standard Oil Co., Caixa Postal 970, Brazil.

PENNEY, John Mortimer, Oilfield Manager, c/o Ecuador Oilfields Ltd., Guayaquil, Ecuador (Trans. from Associate Member). (*Ashley Carter ; A. F. Dabell.*)

PERRY, Harold Gladstone Bright, Engineer, Standard-Vacuum Oil Company, Inc., 94, Canton Road, Shanghai, China. (*S. J. M. Auld ; N. G. Gullick.*)

PROVEST, Thomas Gordon, Technical Sales Representative (*Lubricating & Fuel Oils, Ltd.*), 36, Deansgate Arcade, Manchester, 3. (*W. Smellie ; J. Barrett.*)

RADJY, Abol Hassan (Trans. from Student), Chemical Engineer, c/o Anglo-Iranian Oil Co., Ltd., Masjid-i-Sulaiman, South Iran. (*A. W. Nash ; C. E. Wood.*)

ROGER, Rudolf Herbert, Director (*N.V. Petroleum Handel Maatschappij, Amsterdam C.*), de Ruyterkade 125, Amsterdam C. (*A. E. Dunstan ; L. J. Le Mesurier.*)

STOCK, Hellmut, Engineer, Ruhrbenzin A.G. Oberhausen, Hotten, Germany. (*C. S. Snodgrass.*)

SWERISSEN, Herman Theodoor, Manager (*Manheim Refinery of the Rhenania Ossag*), Monheim Bez Durseldorf, Kapellenstrasse 52, Germany. (*H. L. Buning ; G. Voogt.*)

WILSON, Cecil Edward, Engineer, Trinidad Petroleum Development Co., Palo Seco, Trinidad, B.W.I. (*H. V. Lavington ; L. A. Bushe.*)

WOODFIELD, Harry (Trans. from Associate Member), Manager, c/o The Rising Sun Petroleum Co., Ltd., Yokohama, Japan. (*J. Kewley ; N. Mitchell.*)

ARTHUR W. EASTLAKE,
Honorary Secretary.

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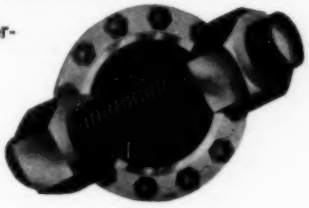

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PERSONAL NOTES.

Mr. B. G. Banks has returned from Trinidad.

Dr. A. E. Dunstan is in the U.S.A.

Mr. K. W. Gray has left Australia and is in England.

Mr. D. Glynn Jones has left for Palestine.

Mr. J. Kewley is in the U.S.A.

Mr. J. A. Lindsay is home from Trinidad.

Mr. R. I. Martin is leaving for Trinidad.

Mr. F. V. P. Perrott is home from the U.S.A.

Mr. D. R. M. Pickard has returned from Iran.

Mr. H. E. F. Pracy is home from Trinidad.

Mr. J. G. Smillie has left Ecuador and is now in Venezuela.

The Secretary would be glad to learn of the addresses of the following members: W. T. Mendell, A. N. K. S. Mohandes, K. A. Spearing, M. L. Thomas, and A. W. Thompson.

CONTENTS OF OCTOBER JOURNAL.

The following papers are scheduled for inclusion in the October issue of the *Journal*:

"Determination of Critical Temperature and Pressure of Petroleum Products by a Flow Method." L. C. Roess.

"Thermal and Time Factors in Carburation." J. Small.

"Hard Facing of Oil-Well Tools." E. W. Bentley.

"Integration Errors in the Measurement of Gas Flow through an Orifice." H. Gilmour.

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NOTICES.

The Institution as a body is not responsible for the statements of opinion expressed in any of its publications.

Copyright.—Publication of abstracts of Papers and articles appearing in the Journal is permitted, provided that acknowledgment is made to the Institution of Petroleum Technologists.

Papers and Articles.—The Council invites Papers and Articles both for reading at Ordinary Meetings of the Institution and for publication in the *Journal*. All Papers, whether for reading or publication, will be submitted to a referee appointed by the Publication Committee.

The Institution has published a brochure "Instructions for the Guidance of Authors" containing details of recommended practice in the preparation of Papers for publication. Copies of this brochure will be supplied on request.

Pre-Prints.—Advance proofs of Papers to be read at Ordinary Meetings are generally available about a week before the Meeting. Members wishing to be supplied with these pre-prints are requested to notify the Secretary.

Abstracts.—Members and Journal Subscribers desirous of receiving the Abstracts printed on one side of the paper only, can be supplied with these at a charge of 10*s.* per annum per copy, payable in advance.

Issue of Journal.—Members whose subscription is not in arrear receive the *Journal* free of cost. A member whose subscription is not paid by March 31st of the year for which it is due is considered to be in arrear.

Changes of Address.—Members are requested to notify any change of address to the Secretary.

Benevolent Fund.—The Benevolent Fund is intended to aid necessitous persons who are or have been members of the Institution, and their dependent relatives.

The Fund is raised by voluntary annual subscriptions, donations, and bequests, and all contributions should be sent to the Secretary of the Institution at Aldine House, Bedford Street, London, W.C. 2. The Fund is administered by the Council through the Benevolent Fund Committee, and all applications in connection therewith must be made on a special form which can be obtained from the Secretary of the Institution.

Appointments Register.—A register of members requiring appointments is kept at the offices of the Institution, and every effort is made to assist members of the Institution in search of employment.

Members who desire their names and qualifications to be included in this register are requested to apply to the Secretary for the Form of Application for Registration, if they have not already done so. Members residing in the London area are asked, if possible, to return this Form in person and make themselves known, together with their requirements, to the Secretary. It is also requested that members should notify the Secretary immediately they have obtained an appointment.

In submitting names of candidates to prospective employers it is understood that the Institution accepts no responsibility and gives no guarantee.

Library.—The Institution's Library may be consulted between the hours of 9.30 a.m. and 5 p.m. daily. (Saturdays, 9.30 a.m. to 12 noon.)

INSTITUTION NOTES.

October 1936.

FORTHCOMING MEETINGS.

Monday, November 2nd, at the Chemical Society, Burlington House, Piccadilly, W.1. at 8.0 p.m.

Joint Meeting with the Society of Chemical Industry, London Section.

"The Manufacture of Chemical Products derived from the Petroleum Industry," by Dr. A. E. Dunstan, D.Sc., F.I.C.

Tuesday, November 10th, at the Royal Society of Arts, John Street, Adelphi, London, W.C.2.

Symposium of Papers on "Geophysics."

"Temperature Measurements in Oil Wells," by M. Schlumberger, H. G. Doll and A. A. Perebinossoff.

"Exploration by the Reflection Seismograph in the Gulf Coast of Texas and Louisiana," by Dr. E. E. Rosaire.

"A Method of Testing Reflection Seismographs," by Dr. J. H. Jones.

"The Use of Reversed Refraction Arcs in Seismic Surveying," by R. Davies.

Tuesday, December 8th, at the Royal Society of Arts, John Street, Adelphi, London, at 5.30 p.m.

Open discussion on "The Organization of Research in the Petroleum Industry." Introductory papers will be read by Ir. J. H. Vermuelen and D. A. Shepard.

STUDENTS' SECTION (LONDON BRANCH).

Thursday, November 5th, at 6.15 p.m., at Aldine House. "Asphalt," by A. D. Davidson (Student).

Tuesday, November 17th, at 6.15 p.m., at the Chemical Society, Burlington House, Piccadilly, W.1.

Annual Open Meeting.

"Recent Developments in Refinery Technology," by Prof. J. S. S. Brame, C.B.E., F.I.C., F.C.S.

Tuesday, December 1st. Visit to the works of Messrs. Prices Patent Candle Co., Ltd.

Tuesday, December 15th. Joint Meeting with the London Branches of the Graduates Section of the Institution of Automobile Engineers and the Students' Section of the Royal Aeronautical Society.

"Fuels for Aero Engines," by C. H. Barton, M.A., A.I.C.

NORTHERN BRANCH.

Wednesday, November 18th. "Interesting Applications of Petroleum," by C. Chilvers, B.Sc., F.I.C., F.C.S.

Wednesday, December 16th. "High Performance Fuels," by H. C. Tett, B.Sc., D.I.C., A.R.C.S.

These meetings will be held at the Constitutional Club, St. Ann's Street, Manchester, 2, at 7 p.m.

NEW MEMBERS.

The following have been elected by the Council in accordance with the Bye-Laws since the last issue of the *Journal*. Election or transference is subject, in each case, to confirmation in accordance with Bye-Law Sect. IV, paras. 9 and 10.

Members.

Black, Alexander Wylie	Hong Kong.
Brey de, Jan Heinrick Christoph	The Hague.
Currie, James Leslie	Liverpool.
Petrikevitch, Nicolas	London.
Pound, Gerald Stephen	Barnsley.
Sleight, Glenn Coutes	Michigan.
Ward, Percy James	London.
Webster, William Armstrong	Cheadle Hume.

Transfer to Members.

Ballet, Jacques	Port Jerôme.
Howes, Donald Albert	Sunbury-on-Thames.
Rendel, Terence Blair	Illinois.
Watts, Harry Temple	London.

Associate Members.

Lazian, Mrs. Galena	London.
Lusty, Iver	Derby.
McKee, John Lockhart	Bahrein Island.
Smith, Norman Wilson	Liverpool.
Tilling, Arthur Henry Gwynne	Ellesmere Port.
Watson, Archibald	Brighouse.

The derrick floor of Pirgah No. 2, at the end of the last pull-out, showing Rotary Table, Drawworks and Seamark Blow-out Preventer, all manufactured by the Oil Well Engineering Co., Ltd.

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Transferred to Associate Members.

EVANS, Arthur	Seaham Harbour.
ROBSON, Thomas Gordon	Upper Assam.

Students.

DAVID, William Anker Lewis	London.
PENNY, Basil	London.

CANDIDATES FOR ADMISSION.

The following have applied for admission to the Institution and in accordance with the Bye-Laws the proposals will not be considered until after the lapse of at least one month subsequent to the issue of this *Journal*, during which any Member or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of any candidate.

The object of this information is to assist the Council in grading candidates according to the class of membership.

The names of the candidate's proposer and seconder are given in each case, except as provided by Bye-Laws, Sect. IV. 3.

BENNETT, Richard Gordon, Driller, Messrs. Trinidad Leaseholds, Ltd., Barrackpore, Trinidad. (*H. D. Fletcher; F. Middleton.*)

BRIGGS, Leo Wendell, General Superintendent of Gas Works (*Cia. Energia Electrica Rio Grandense*), Caixa Postal 256, Porto Alegre, Rio Grande de Sul, Brazil.

JESSOP, Philip, Geologist, British Burmah Petroleum Co., Yenanyaung, Upper Burma. (*W. R. S. Henderson; C. E. Keep.*)

KENNEDY, Edward Dacosta, Engineer, British Controlled Oilfields, Ltd., River Plate House, Finsbury Circus, London, E.C.3. (*H. V. Lavington; L. K. White.*)

NOKES, George Wilmot Ingle, Engineer (*Berry Wiggins & Co., Ltd.*), 71, Cleveland Road, South Woodford, E.18. (*T. W. S. Robinson; G. W. Ford.*)

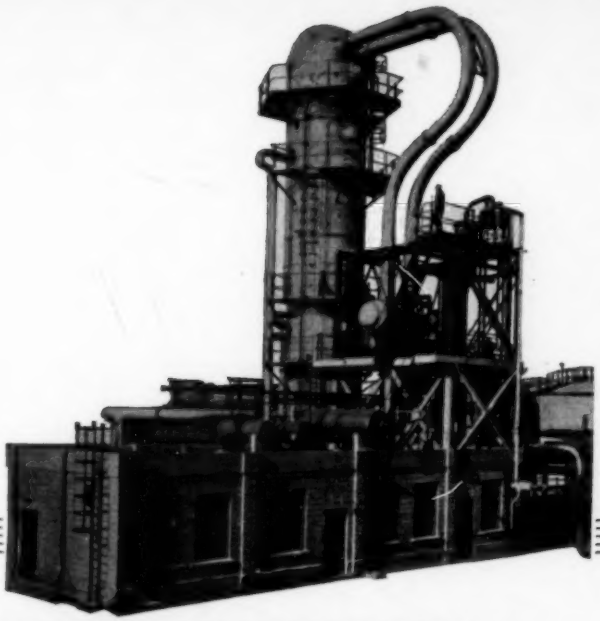
PLEETH, Samuel John Warren, Chemist (*Cleveland Petroleum Products, Ltd.*), 10, Gloucester Court, 33, Gloucester Road, N.W.1. (*J. S. Jackson; J. Parrish.*)

TEMPLE, Denis, Engineering Student (*Anglo-Iranian Oil Co.*), 19, Wellesley Road, Chiswick, W.4. (*Prof. A. J. S. Pippard.*)

VEGH-GARZON, Carlos R., General Manager (*Administración Nacional de Combustibles, Alcohol y Portland*), San Salvador 2040, Montevideo, Uruguay.

WILSON, Jack Marston, Chemist (*Shell-Mex & B.P., Ltd.*), 43, The Byeways, Surbiton, Surrey. (*J. S. Jackson; A. M. E. Beavan.*)

ARTHUR W. EASTLAKE,
Honorary Secretary.



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BRANCH NOTES.

Burma Branch.

A meeting of the Burma Branch was held in the Volunteer Club, Yenangyaung on 28th August. Mr. W. E. V. Abraham, B.Sc., F.G.S. (Chairman of the Branch), delivered a very interesting Paper on "Geological Aspects of Deep Drilling Problems." Fifty members and visitors were present, and the paper was followed by a discussion in which Messrs. J. A. Butlin, J. Coates, E. J. Bradshaw, J. Bayliss and C. E. Keep took part.

This meeting was the first of a series of four which it is hoped to hold during the next few months dealing with different aspects of deep drilling problems.

Northern Branch.

On Wednesday, 23rd September, a party of over sixty members of the Northern Branch visited the Lubricating Oil Refinery and Barrel-Making Plant of the Anglo-American Oil Co., Ltd., at Mode Wheel, and afterwards the Grease-Making Plant of Shell-Mex & B.P., Ltd., Barton.

The various processes at both works were very lucidly explained by a number of guides attached to the party. Mr. R. Macdonald, B.Sc., gave a short talk at the Barton Plant on the technical nature of the processes of Grease-Making. At this plant the Company manufactures about 120 grades of all types of cup greases, lime and soda-base greases, axle, gear and special greases.

The thanks of the Committee and members are due to the Anglo-American Oil Co., and Shell-Mex & B.P., Ltd., for permission to visit these refineries, and also to the former Company for their kindness in providing the party with refreshments.

PERSONAL NOTES.

Mr. R. V. Browne has left for Syria.
Mr. H. C. Carter has returned to Yenangyaung.
Mr. A. D. Cooper is home from Singapore.
Mr. F. A. Couse is returning to India.
Mr. W. G. B. Coutts has left Iran for Scotland.
Mr. D. T. Germain-Jones has returned to Masjid-i-Sulaiman.
Mr. P. E. Groves has left for Burma.
Mr. W. R. S. Henderson is returning to England.
Commander H. V. Lavington has returned to Trinidad.
Mr. R. H. Mitchell has left for Burma.
Mr. P. N. D. Porter is home from Egypt.
Mr. F. G. Rappaport has returned to Venezuela.
Mr. G. Stewart Taitt has left for Miri.
Mr. C. W. Woolgar has left for Curacao, D.W.I.

We regret to record the death, at Edinburgh on June 13th, 1936, of Carlos Bernard McKeever, an Original Member of the Institution and one of those who agreed to become a member prior to the Foundation.

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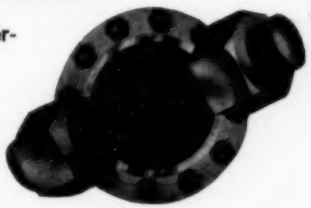

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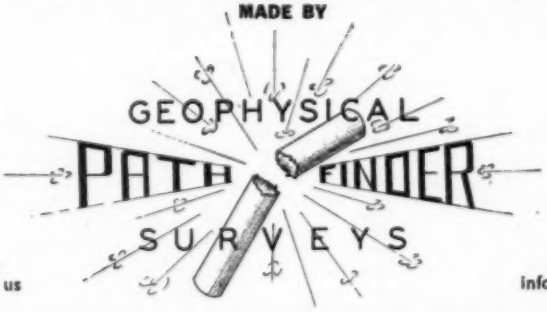

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INSTITUTION NOTES.

NOVEMBER 1936.

NOMINATIONS FOR COUNCIL.

Nomination Papers for candidates for election to the Council must be delivered to the Secretary of the Institution not later than Monday, November 30th.

Every Member and Associate Member of the Institution may send in writing to the Council the name of a Member whom he desires to recommend for election to the Council. This nomination must be signed by at least nine other Members or Associate Members. No Member or Associate Member may sign more than one Nomination Paper in any one year. (Bye-Laws Sect. VIII. 5.)

Nomination Forms are kept at the Institution office for the convenience of Members, and will be supplied on request by the Secretary. It is not, however, necessary that these Forms be used. Any nomination which complies with the requirements given above will be considered valid.

FORTHCOMING MEETINGS.

INSTITUTION MEETING.

Tuesday, December 8th, at the Royal Society of Arts, John Street, Adelphi, London, at 5.30 p.m.

Open discussion on "The Organization of Research in the Petroleum Industry." Introductory papers will be read by Ir. J. H. Vermuelen and D. A. Shepard.

STUDENTS SECTION, LONDON BRANCH.

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Tuesday, December 15th. Joint Meeting with the London Branches of the Graduates Section of the Institution of Automobile Engineers and the Students' Section of the Royal Aeronautical Society.

"Fuels for Aero Engines," by C. H. Barton, M.A., A.I.C.

INSTITUTION SCHOLARSHIP.

The Institution Scholarship of £40 per annum tenable at the Royal School of Mines has been awarded to Eric N. Tiratsoo on the recommendation of the Governors of the Imperial College of Science and Technology.

Mr. Tiratsoo was educated at St. Paul's School and entered the Oil Technology Course of the Royal School of Mines in 1934. He was elected a Student of the Institution in December 1935.

2ND WORLD PETROLEUM CONGRESS.

The Council is working in close co-operation with the Comité d'Organisation of the Second World Petroleum Congress to be held in Paris on June 14th–19th, 1937, and is represented on the French Committee by Dr. A. E. Dunstan, Mr. J. Kewley and Mr. S. J. Astbury. The detailed work of the collection of Papers is being undertaken by a series of National Committees. The Council of the Institution of Petroleum Technologists is operating as the National Committee for Great Britain, the Dominions and the British Colonial Empire, and has appointed the following Reporters for Sections I–IV of the Congress.

Sect. I. Geology and Exploitation.

Geology.	Mr. J. Romanes.
Production.	Mr. C. A. P. Southwell.
Drilling.	Mr. J. Cuthill.
Geophysics.	Dr. H. Shaw.

Sect. II. Physics, Chemistry and Refining.

Hydrogenation.	Mr. K. Gordon.
Bitumens.	Mr. J. S. Jackson.
Refining.	Dr. A. E. Dunstan and Mr. J. Kewley.

Sect. III. Materials and Construction. Mr. C. Dalley.

Sect. IV. Utilization. Mr. C. H. Barton, Mr. R. Stansfield, Mr. C. H. Sprake and Dr. F. H. Garner.

Members of the Institution resident in Great Britain, Australia, Canada, India and Burma, New Zealand, South Africa, the British Colonial Empire or Egypt, who intend to present a Paper at the 2nd World Petroleum Congress should get in touch without delay with the Reporter of the appropriate Section as given above. Letters may be addressed c/o The Institution, Aldine House.

Papers will be welcomed on any subject coming within the scope of the General Programme issued from Paris in May 1936. They should preferably deal with work which has been carried out or developments made since the 1st World Petroleum Congress of July 1933. Papers may be written in English, French or German, and should be accompanied by a summary not exceeding 400 words.

Members Resident in other Countries.

The National Committees for Austria, Germany, Holland and Roumania are as follows:

Austria. Osterreichisches Petroleum Institut.
President: Prof. H. Suida,
Eschenbachgasse 9, Vienna 1.

Germany. Deutsche Gesellschaft fur Mineralölforschung.
President: Prof. Dr. L. Ubbelohde,
Dorotheenstrasse 40, Berlin, W.7.

Holland. Koninklijk Instituut van Ingenieurs.
General Secretary: Ir. Wouter Cool,
23, Prinsessegracht, The Hague.

Rumania. Comité National Romain de Forage.
President: Prof. L. Mrazec,
1, Bd. I.C. Bratianu, Bucarest.

Members of the Institution resident in these countries who intend to present a communication to the Congress are asked to submit Papers through the National Committees given above, and not through the Institution.

Members in U.S.A. should submit Papers through the American Association of Petroleum Geologists or the Society of Automotive Engineers.

In countries not included in the British Empire, where no National Committee has been formed, members of the Institution are asked to submit Papers direct to the Sécrétariat-Général du Congrès, 85, Boulevard Montparnasse, Paris 6e.

Membership of the Congress.

Enrolments for membership of the Congress should be forwarded in all cases to the Sécrétariat-Général, 85, Boulevard Montparnasse, Paris 6e, accompanied by the enrolment fee of 50 francs for members and 25 francs for ladies. This will entitle the member to the receipt of all circulars regarding the programme of excursions and visits which are being arranged for the weeks immediately preceeding and following the Congress.

NEW MEMBERS.

The following have been elected by the Council in accordance with the Bye-Laws since the last issue of the Journal. Election or transference is subject, in each case, to confirmation in accordance with Bye-Laws, Sect. IV, paras. 9 and 10.

Members.

CHAPELLE, Ernest Benjamin	Fife.
LAUNY, Sverre	Norway.
PERRY, Harold Gladstone Bright	Shanghai.
ROGER, Rudolf Herbert	Amsterdam.
STOCK, Hellmut	Germany.
SWERISSEN, Herman Theodoor	Germany.

Transferred to Members.

DAWIDSON, Emanuel	Poland.
PENNEY, John Mortimer	Ecuador.
WOODFIELD, Harry	Yokohama.

Associate Members.

BUTLER, Cyril Dean	London.
EVANS, Stanley Hugh	Melbourne.
GOODEY, John Hill	Melbourne.
HEPWORTH, Anthony Morice	Salford.
HOOPER, Leslie	Llandarcy.
WILSON, Cecil Edward	Trinidad.

Transferred to Associate Member.

RADJY, Abol Hassan	Iran.

Associates.

BALLARDIE, Alfred William	London.
KESSEN, Henry Essler	Liverpool.

Student.

FREWING, Joseph John	London.

CANDIDATES FOR ADMISSION.

The following have applied for admission to the Institution, or transfer to another grade of membership, and in accordance with the Bye-Laws the proposals will not be considered until after the lapse of at least one month subsequent to the issue of this Journal, during which any Member or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of any candidate.

The object of this information is to assist the Council in grading candidates according to the class of membership.

The names of the candidate's proposer and seconder are given in each case, except as provided by Bye-Laws, Sect. IV. 3.

CATCHPOLE, William Marcus (Trans. from Student), Chemist, Anglo-Iranian Oil Co., Ltd., P.O. Box No. 1, Chertsey Road, Sunbury-on-Thames, Middlesex. (*D. G. Smith*; *D. A. Howes.*)

HARRISON, Christopher Heathfield, Col. Deputy Director of Supplies, Army Headquarters, Simla, India.

HYDE, John Welford (Trans. from Student), Chemist (*Anglo-Iranian Oil Co., Ltd.*), "Inverey," Eversley Road, Surbiton, Surrey. (*D. G. Smith*; *D. A. Howes.*)

MACKLEY, Kenneth John, Refinery Supervisor (*London and Thames Haven Oil Wharves, Ltd.*), "Chippinge," Pine Avenue, Gravesend, Kent. (*E. Lawson Lomax*; *C. E. Evans.*)

MYDDLETON, William Whalley, Chemist (*Robinson Bindley Processes, Ltd.*), "Warrendale," Coombe Lane, Kingston-on-Thames, Surrey. (*F. B. Thole*; *E. B. Whalley.*)

NEVILLE, Warwick, Chemical Engineer (*Cia Mexicana de Petroleo, "El Aguila"*), Apartado 54, Minatitlan, Ver., Mexico. (*J. McConnell Sanders*; *G. Davidson.*)

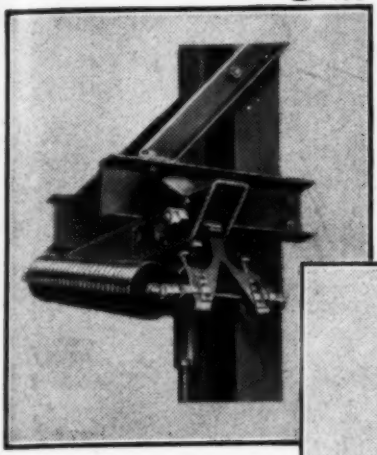
READ, Alfred Leonard (Trans. from Associate Member), Chemist (*Sternol, Ltd.*), 8, Carterhatch Lane, Forty Hill, Enfield. (*C. Chilvers*; *A. M. Nicholas.*)

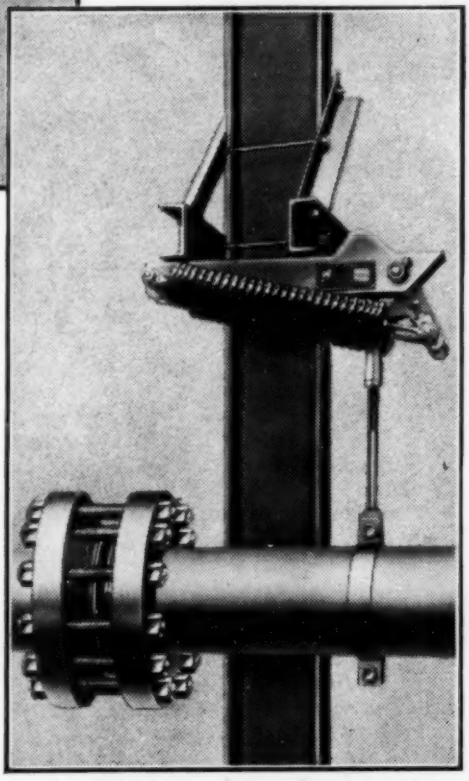
WITHERS, John Granville (Trans. from Student), Engineer, Anglo-Iranian Oil Co., Ltd., P.O. Box No. 1, Chertsey Road, Sunbury-on-Thames, Middlesex. (*R. Stansfield*; *D. G. Smith.*)

WOOLER, John, Technical Manager (*William Briggs & Sons, Ltd.*), "Thornwood," Old Craigie Road, Dundee, Scotland. (*G. L. Hunting*; *P. L. Hunting.*)

ARTHUR W. EASTLAKE.
Honorary Secretary.

The BABCOCK GENSPRING CONSTANT SUPPORT





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BRANCH NOTES.

Trinidad Branch.

The 6th Annual Dinner of the Trinidad Branch of the Institution was held at the Queen's Park Hotel, Port-of-Spain, Trinidad, on Saturday, November 7th, 1936.

Burma Branch.

Mr. J. A. Butlin, A.M.Inst.P.T., delivered a very interesting Paper on "Rotary Drilling Equipment for Deep Wells" before a meeting of the Burma Branch, held at the Volunteer Club, Yenangyaung, on Friday, September 25th, 1936.

Forty-six members and visitors were present, and the Paper was followed by a discussion in which Messrs. W. E. V. Abraham, J. Baylis, J. Coates, W. C. Schmitton and C. E. Keep took part.

Northern Branch.

Mr. L. J. Le Mesurier, M.I.N.A., M.Inst.Mar.Eng., addressed a meeting of the Northern Branch at the Constitutional Club, Manchester, on Wednesday, October 21st, 1936. This meeting was held in conjunction with the local Branch of the Institute of Fuel, and about one hundred members and visitors were present. Mr. Le Mesurier's subject was "Diesel Engines and Diesel Fuels."

In a subject covering so wide a field it was only possible to deal in outline with the more important features of design. Mr. Le Mesurier therefore gave a general survey of the development of the Diesel engine from air injection, via direct and mechanical injection with low-compression pressures, to direct injection with high compression. Present-day designs of fuel pumps, injection valves and combustion chambers were described.

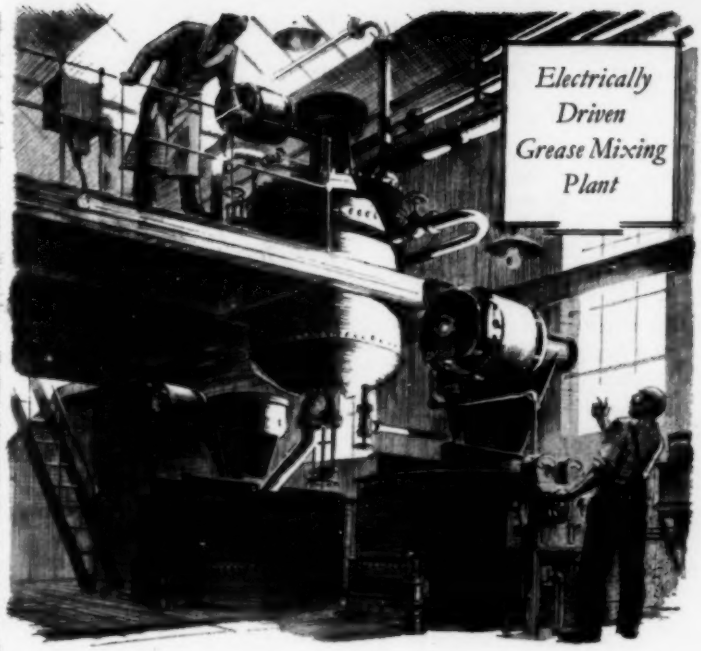
The different qualities of fuel required to meet the requirements of different classes of engines were discussed. In general, large slow-running engines, particularly those of the air-injection type, were least sensitive to fuel quality. The best fuels were demanded by the small high-speed type, due partly to the confined combustion chamber and partly to the necessity for complete ignition and combustion in an extremely short interval of time.

The specifications of the B.S.I. dealing with flash point, ignition quality or aniline test, hard asphalt, Conradson carbon, ash, viscosity, pour point, sulphur content, water content, distillation range and calorific value were explained in detail. The test for ignition quality was stressed as being the most important.

In the discussion which followed the Paper, the following took part: Messrs. Begg, Chilvers, Frazer, Jones and Stubbs.

Dinner in U.S.A.

The Members of the Institution resident in America held their 2nd Annual Dinner at Chicago, on Tuesday, November 10th, 1936. A report of this function will be given in the next issue of the Journal.



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Students Section (London Branch).

A Committee has been formed representative of the London Junior Members Branches of the following institutions:

Institute of Marine Engineers.
Institution of Automobile Engineers.
Institution of Civil Engineers.
Institution of Petroleum Technologists.
Institution of Production Engineers.
Institution of Structural Engineers.
Royal Aeronautical Society.

with the object of drawing up a syllabus of meetings arranged by the junior Sections of each organization. The programme up to the end of February 1937 has now been published, and copies can be obtained from the Hon. Secretary of the Committee, Mr. B. C. Ferguson, St. Helen's Court, Great St. Helens, E.C.3. (Telephone: Avenue 9820, Extension 316.)

All the meetings listed in the programme, totalling over forty, are open to members of the participating societies on application for tickets of admission to the appropriate authority.

The first meeting under this scheme was that held on Tuesday, October 6th, 1936, at Aldine House, when Mr. W. E. Gooday, A.R.S.M., D.I.C. (Member of Council), addressed the London Students on "Technical Aspects of Lubricating Oil Sales."

PERSONAL NOTES.

Lt.-Col. S. J. M. Auld, M.C., O.B.E., D.Sc. (Vice-President), represented the Council at the Meetings of the Deutsche Gesellschaft für Mineralölforschung in Berlin on November 5th–7th.

Professor P. N. Koggerman, M.Sc., D.I.C., F.C.S., has been appointed first Rector of the Institute of Technology at Tallinn, Estonia, which was opened in July 1936.

Lieut. J. H. Blakiston is home from Sarawak.
Mr. D. H. Carter has returned from Mexico.
Mr. F. A. Couse is returning to India.
Mr. F. E. J. Foxall-Smedley is returning to Burma.
Mr. C. E. Hobley is in Venezuela.
Mr. H. E. King has returned to Burma.
Mr. F. A. Mare has left for Upper Assam.
Mr. W. T. Mendell is in California.
Mr. C. V. Rutherford has returned to Iran.
Mr. C. Thomas has left for Assam.
Mr. L. A. Toone has left Trinidad, and is now in Sarawak.
Mr. T. A. Webb is returning from India.
Mr. J. C. Wood-Mallock has left for Ecuador.

The Secretary would be glad to learn of the addresses of the following members: R. A. Chisholm, A. N. K. S. Mohandes, M. A. Saib, H. N. Sher, K. A. Spearing, and M. L. Thomas.

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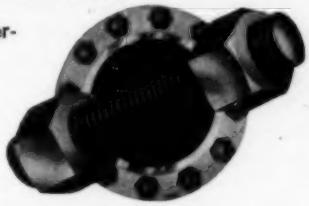

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LIST OF MEMBERS.

Corrections.

The following corrections to the List of Members have been noted since the date of issue, October 13th, 1936. The correct form is given below :—

Members.

BOWEN, Arthur Ridley, D.Sc., Ph.D., F.I.C., A.M.I.Chem.E., Principal, County Technical College, Newark, Notts. (A.M. 1926.)

HENDERSON, James Alexander Leo, Ph.D., F.G.S., M.Inst.M.M., 1, London Wall Buildings, London, E.C. 2.

(*To be inserted.*) MARTYNIK, Ing. Jan, Willa Oksza, Zakopane, Poland.

Associate Members.

DICKINSON, George, c/o The A.A., Fanum House, New Coventry Street, London, W.1. (Stud. 1925.)

MACNIVEN, Hugh, M.Inst.Mar.Eng., c/o Anglo-Iranian Oil Co., Ltd., Masjid-i-Sulaiman, South Iran.

SEFTON, Ronald, B.Sc., A.I.C., 42, Cephas Street, Mile End, London, E. 1.

Topographical Index.

Summary of Topographical Index printed on pp. 72–85 of the recently published List of Members, corrected to September 30th, 1936

Great Britain.		
London and Home Counties	495	
Other Districts	221	
		716
Europe.		
France	29	
Germany	10	
Holland	23	
Roumania	49	
Other Countries	38	
		149
North America.		
U.S.A.	95	
Canada	12	
		107
Trinidad		57
Central and South America		85
Africa		32
Asia.		
Burma	46	
India	17	
Iran	72	
Iraq	15	
East Indies	14	
Malay States	8	
Other Countries	30	
		202
Australia and New Zealand		25
Members' Addresses not known		8
		1381

INSTITUTION NOTES.

DECEMBER 1936.

ELECTION OF PRESIDENT.

The Council has elected Lt.-Col. S. J. M. Auld, O.B.E., M.C., D.Sc. (Vice-President) to be President of the Institution for the year 1937–38.

ELECTION OF VICE-PRESIDENTS.

The following have been elected Vice-Presidents of the Institution for the year 1937–38: Ashley Carter, A.M.I.Mech.E.; C. Dalley, M.I.E.E.; F. H. Garner, Ph.D., M.Sc., F.I.C.; Prof. A. W. Nash, M.Sc., M.I.Mech.E.; J. McConell Sanders, F.I.C., F.C.S.; F. B. Thole, D.Sc., F.I.C., F.C.S.

AWARD OF THE REDWOOD MEDAL.

The Council has awarded the Redwood Medal to Mr. Harry Ricardo, B.A., F.R.S., in recognition of his distinguished services to the science and technology of petroleum.

Mr. Ricardo was elected a Fellow of the Royal Society in 1928, and an Honorary Member of the Institution of Petroleum Technologists in 1928. Among the many scientific honours which have been conferred upon him are the Silver Medal of the Royal Aeronautical Society (1921), the Crompton Medal of the Institution of Automobile Engineers (1927), and the Melchett Medal of the Institute of Fuel (1935).

The presentation of the Medal will be made by the President on the occasion of the Annual General Meeting of the Institution in March 1937.

AWARD OF STUDENTS MEDAL AND PRIZES.

The Students Medal has been awarded to Mr. C. S. Newey (Birmingham University) for his Paper on "The Dynamics of a Producing Reservoir."

The Students Prize has been divided equally between Mr. Newey and Mr. J. H. Dove (Birmingham University). Mr. Dove's Paper was entitled "Viscosity–Temperature Relationships of Lubricating Oils."

No award has been made of the Students Prize presented by Mr. T. C. J. Burgess.

FORTHCOMING MEETINGS.

Institution Meetings.

The January 1937 Meeting will be a Joint Meeting with the Royal Aeronautical Society and the Institution of Automobile

Engineers, held at the Royal Society of Arts, John Street, Adelphi, at

5.30 p.m. on Friday, 8th January.

(Kindly note that it will not be possible to provide tea and refreshments prior to the meeting.)

Mr. F. R. Banks, O.B.E., F.R.Ae.S., M.I.A.E., will present a Paper on "*Some Problems of Modern High-Duty Aero Engines and their Fuels.*"

Advance copies of the Paper will be available in January, and will be supplied by the Secretary on application.

Northern Branch.

20th January, 1937. "*Kerosine, Its Glorious Past and Future Prospects,*" by Mr. J. Kewley, M.A., F.I.C., F.C.S. (Past President), at 7 p.m. at the Constitutional Club, St. Ann's Street, Manchester, 2.

Students Section (London Branch).

20th January, 1937. "*Production,*" by Mr. A. F. Dabell, M.I.Mech.E. (Member of Council), at the Institution offices, Aldine House, at 6.15 p.m.

NEW MEMBERS.

The following have been elected by the Council in accordance with the By-Laws since the last issue of the *Journal*. Election or transference is subject, in each case, to confirmation in accordance with By-Law Sect. IV, paras. 9 and 10.

Members.

Wilson, Jack Marston...	Surbiton.
Vegh-Garzon, Carlos R.	Montevideo.

Associate Members.

Bennett, Richard Gordon	Trinidad.
Jessop, Philip	Yenangyaung.
Kennedy, Edward Dacoster	London.
Nokes, George Wilmot	London.
Pleeth, Samuel John Warren	London.

Student.

Temple, Dennis	London.

Associates.

Clifford, Guy	Bahrein Island.
Provest, Thomas Gordon	Manchester.

CANDIDATES FOR ADMISSION.

The following have applied for admission to the Institution, or transfer to another grade of membership, and in accordance with the By-Laws the proposals will not be considered until after the lapse of at least one month subsequent to the issue of this *Journal*, during which any Member or Associate Member may communicate by letter to the Secretary, for the confidential information of the

Council, any particulars he may possess respecting the qualifications or suitability of any candidate.

The object of this information is to assist the Council in grading candidates according to the class of membership.

The names of the candidate's proposer and seconder are given in each case, except as provided by By-Laws, Sect. IV. 3.

BLAKISTON, John Horace (Trans. from Associate Member), Exploitation Engineer, Anglo-Saxon Petroleum Co., Ltd., St. Helen's Court, E.C.3. (*A. W. Nash ; L. V. W. Clark.*)

BROOKS, G. E., Refinery Operator (*London & Thames Haven Oil Wharves, Ltd.*), "Conquest," Abbott's Hall Chase, Stanford-le-Hope, Essex. (*E. Lawson Lomax ; C. E. Evans.*)

DEWDNEY, Duncan Alexander Cox (Trans. from Student), Chemist (*International Association (Petroleum Industry) Ltd.*), 447, Thames House, Millbank, S.W.1. (*F. H. Garner ; A. W. Nash.*)

DYSON, George Malcolm, Head of Pure and Applied Science Department (*Loughborough College*), Clifton House, Albert Place, Loughborough, Leics. (*S. J. M. Auld ; A. R. Bowen.*)

FARMERY, Joshua William, Lecturer, Military College of Science, Woolwich, S.E.18. (*P. N. Kogerman ; H. B. Milner.*)

GODFREY, Michael Wanless, Student (*Royal School of Mines*), 8, Penywern Road, Earls Court, S.W.5. (*V. C. Illing*).

GREENWOOD, William Arthur, Assistant Chemist (*Shell-Mex & B.P. Ltd.*), 117, Fishponds Road, Upper Tooting, S.W.17. (*H. E. Priston ; D. L. Samuel.*)

HALL, Frank Clifford (Trans. from Student), Research Student (*Birmingham University*), 6, Frederick Road, Selly Oak, Birmingham. (*A. W. Nash ; L. V. W. Clark.*)

HIGGINS, George Esmond, Student (*Royal School of Mines*), 5, St. Martins Mansions, Ullswater Road, W. Norwood, S.E.27. (*V.C. Illing.*)

HUNTER, Thomas Girvan, Lecturer (*Birmingham University*), 130, Hanging Lane, Northfield, Birmingham. (*A. W. Nash ; L. V. W. Clark.*)

JOHNSTON, Herbert Charles William, General Manager, Trinidad Leaseholds, Ltd., Point-a-Pierre, Trinidad, B.W.I. (*F. L. Melvill ; E. C. Scott.*)

KAUFFELD, Theodore John, Engineer, Alfa Laval Co., Ltd., 305, Shell-Mex House, Strand, W.C.2. (*W. B. Dick ; J. Campbell Robb.*)

KIND, Franz, Managing Director, "Aguila" Soc. An. Tecnico Industriale, Trieste, Italy. (*Harold Moore ; R. B. Hobson.*)

MOLD, Clarence Edward, Chief Chemist, Price's Patent Candle Co., Ltd., Belmont Works, Battersea, S.W.11. (*J. S. Jackson ; D. L. Samuel.*)

MONTI, Ernesto, Plant Manager, "Aguila" Soc. An. Tecnico Industriale, Trieste, Italy. (*Harold Moore ; R. B. Hobson.*)

PRENTICE, Harold James, Chemist, 16, Highlands Avenue, Leatherhead, Surrey. (*F. H. Garner ; W. E. J. Broom.*)

RAMBO, William Leonard, Chemist (*Shell Oil Co. of Canada, Ltd.*), 5530, Pie IX Boulevard, Apt. 6, Montreal, Quebec, Canada. (*R. C. Gardiner ; R. K. Stratford.*)

SAWYER, Montagu Frederick, Chemist (*Agwi Petroleum Corpn.*), 28, Holyrood Avenue, Highfield, Southampton. (*H. D. Demoulins ; A. Osborn.*)

SHEPARD, David Allan, Chemical Engineer (*International Association (Petroleum Industry), Ltd.*), Thames House, Millbank, S.W.1. (*F. H. Garner ; C. H. Sprake.*)

STRANG, Leslie Christopher, Research Student (*Birmingham University*), 35, Wheleys Road, Edgbaston, Birmingham. (*A. W. Nash ; L. V. W. Clark.*)

STREETON, Reginald Douglas, Assistant Chemist (*Anglo-American Oil Co.*), 197, Clock House Road, Beckenham, Kent. (*H. C. Tett ; J. L. Taylor.*)

STUBBS, Robert Bertram Eric, Chemist (*Coal & Allied Industries, Ltd.*), 3, The Elms West, Sunderland, Co. Durham. (*T. Cohn ; A. Evans.*)

STYLES, Eric Rofe, Chemist (*Silvertown Lubricants, Ltd.*), 81, Brycedale Crescent, Southgate, N.14. (*W. Lee ; A. T. Wilford.*)

TAIT, Edward James Morrow, Engineer (*Universal Oil Products*), 11, Windermere Court, Wembley, Middlesex. (*B. S. Brailey ; W. H. Jones.*)

THORNELOE, Edouard Ernest, Engineer, Anglo-Iranian Oil Co., Ltd., Abadan, South Iran. (*A. W. Nash ; L. V. W. Clark.*)

TINDALL, Frederick Henry Louis, Engineer, Trinidad Leaseholds, Ltd., Pointe-a-Pierre, Trinidad, B.W.I. (*E. C. Scott ; F. W. Melvill.*)
WEBB, James Frederick Norman, Chemist (*Alex. Duckham & Co.*), 91, Eden Park Avenue, Beckenham, Kent. (*J. S. S. Brame ; S. E. Bowrey.*)
WEBB, Thomas Gilbert (Trans. from Associate), Chemical Engineer, Alco Products Inc., Artillery House, Artillery Row, S.W.1. (*C. H. Edmonds ; E. C. Brewster.*)
WEITZ, John William (Trans. from Associate), General Manager, Vialit Road Products (Pty.), Ltd., Maitland, South Africa. (*H. W. H. Lee ; B. G. Banks.*)

ARTHUR W. EASTLAKE,
Honorary Secretary.

PERSONAL NOTES.

Mr. W. J. BAKER has left for Iran.
Mr. B. G. BANKS is now in Trinidad.
Mr. H. J. W. BRADDICK has returned from Iran.
Mr. L. A. BUSHE has returned to Trinidad.
Mr. R. A. CHISHOLM has left for Iran.
Mr. C. W. FULCHER is in the U.S.A.
Dr. J. A. L. HENDERSON has returned from Canada.
Mr. M. KAMEN KAYE has left for Venezuela.
Mr. H. MACNIVEN is in Iraq.
Mr. P. B. MALING is home from Iran.
Mr. A. MOHANDES has left for Iran.
Mr. M. NAKIB is in Iraq.
Mr. J. B. NIEMAN has left Holland for the Argentine.
Mr. R. M. S. OWEN has left for Iran.
Mr. A. E. PAGE is in Iran.
Dr. J. N. J. PERQUIN has left the Dutch East Indies, and is now in Holland.
Mr. N. PETRIKEVITCH has gone to Russia.
Lieut.-Col. L. D. SCOTT is in Kuwait Island, Iranian Gulf.

The Secretary would be glad to learn of the addresses of the following members: H. J. HALLE, I. C. LOW, S. NICOL, M. A. SAIB, H. N. SHER, K. A. SPEARING, and M. L. THOMAS.

LIST OF MEMBERS.

Corrections.

The following corrections to the List of Members have been noted since the date of issue, October 13th, 1936. The correct form is given below :—

Members.

BONSTOW, Thomas Lacey, M.Inst.C.E., M.I.Mech.E., Whitehall Securities Corporation, Ltd., 47, Parliament Street, London, S.W.1.
BUCK, Edward Clarke, M.Inst.C.E., M.I.Mech.E., F.G.S., 31, Vincent Street, Port of Spain, Trinidad, B.W.I.
GREY, Noel William, A.M.Inst.Chem.E., c/o Lobitos Oilfields, Ltd., Lobitos (via Talara), Peru, South America. (A.M. 1931.)

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BRANCH NOTES.

Northern Branch.

Mr. C. Chilvers, B.Sc., F.I.C., M.Inst.P.T., addressed the Northern Branch in Manchester on 18th November, 1936. Mr. Chilvers' Paper was entitled "Interesting Applications of Petroleum," and referred to a large number of uses of petroleum products which are not commonly dealt with in technical literature.

Dealing with applications in the electrical industry, reference was made to various types of solid-filled cables in which the insulating medium consists of paper impregnated with mineral oil or blends of mineral oil and rosin. A description was given of the oil-filled cable and of the use of petroleum products in transformers, joint boxes, switch gear, metal rectifiers, circuit breakers, and static condensers.

Applications in the metallurgical industries included the use of petroleum products as core oils in the preparation of hollow castings, in the quenching and tempering of steel, in stamping, drawing and rolling operations and also as rust preventatives.

White oils were widely used for medicinal purposes and in the preparation of cold creams, etc. In addition, it was stated there were appreciable outlets for these oils as lubricants for machinery handling foodstuffs, where ordinary types of lubricating oil would contaminate the product. Oiled papers, with special reference to their use for apple wrapping, were briefly mentioned, and also the formation of artificial white oil fogs for the film industry.

Other applications described were the utilization of petroleum products in the manufacture of printing inks and carbon papers, as mould oils, leather processing oils, textile oils and the application of special solvents to degreasing and extraction processes generally.

Lectures on Petroleum Technology.

A course of lectures on petroleum technology is being given at the Manchester College of Technology on Monday evenings from 8 to 9 p.m. This series forms part of a course arranged by the Department of Chemistry and Chemical Technology for persons engaged in the petroleum industries of Manchester and district.

The lecturer is Mr. E. J. Dunstan, M.Sc., M.Inst.P.T. Copies of the syllabus of the course may be obtained from the Honorary Secretary, Northern Branch, I.P.T., Sunlight House (6th Floor), Quay Street, Manchester, 3.

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NOTICES.

The Institution as a body is not responsible for the statements of opinion expressed in any of its publications.

Copyright.—Publication of abstracts of Papers and articles appearing in the Journal is permitted, provided that acknowledgment is made to the Institution of Petroleum Technologists.

Papers and Articles.—The Council invites Papers and Articles both for reading at Ordinary Meetings of the Institution and for publication in the *Journal*. All Papers, whether for reading or publication, will be submitted to a referee appointed by the Publication Committee.

The Institution has published a brochure "Instructions for the Guidance of Authors" containing details of recommended practice in the preparation of Papers for publication. Copies of this brochure will be supplied on request.

Pre-Prints.—Advance proofs of Papers to be read at Ordinary Meetings are generally available about a week before the Meeting. Members wishing to be supplied with these pre-prints are requested to notify the Secretary.

Abstracts.—Members and Journal Subscribers desirous of receiving the Abstracts printed on one side of the paper only, can be supplied with these at a charge of 10*s*. per annum per copy, payable in advance.

Issue of Journal.—Members whose subscription is not in arrear receive the *Journal* free of cost. A member whose subscription is not paid by March 31st of the year for which it is due is considered to be in arrear.

Changes of Address.—Members are requested to notify any change of address to the Secretary.

Benevolent Fund.—The Benevolent Fund is intended to aid necessitous persons who are or have been members of the Institution, and their dependent relatives.

The Fund is raised by voluntary annual subscriptions, donations, and bequests, and all contributions should be sent to the Secretary of the Institution at Aldine House, Bedford Street, London, W.C. 2. The Fund is administered by the Council through the Benevolent Fund Committee, and all applications in connection therewith must be made on a special form which can be obtained from the Secretary of the Institution.

Appointments Register.—A register of members requiring appointments is kept at the offices of the Institution, and every effort is made to assist members of the Institution in search of employment.

Members who desire their names and qualifications to be included in this register are requested to apply to the Secretary for the Form of Application for Registration, if they have not already done so. Members residing in the London area are asked, if possible, to return this Form in person and make themselves known, together with their requirements, to the Secretary. It is also requested that members should notify the Secretary immediately they have obtained an appointment.

In submitting names of candidates to prospective employers it is understood that the Institution accepts no responsibility and gives no guarantee.

Library.—The Institution's Library may be consulted between the hours of 9.30 a.m. and 5 p.m. daily. (Saturdays, 9.30 a.m. to 12 noon.)